WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Periodic Dam Safety Inspection Report

Little Falls Dam
Little Falls Spillway Dam

Lincoln County, Washington

April 2004
04-11-008

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Periodic Dam Safety Inspection Report

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Little Falls Spillway Dam

Lincoln County, Washington

By

David Cummings, P.E.
Structural Specialist

Water Resources Program
Dam Safety Office
Washington State Department of Ecology
PO Box 47600
Olympia, Washington 98504-7600

(360) 407-6623

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Little Falls Dam & Spillway Dams

Periodic Inspection Report

Water Resources Program
Report 04-11-008

The dam safety inspection of the Little Falls Dams, and the engineering analyses and technical material presented in this report were prepared under the supervision and direction of the undersigned professional engineers, in accordance with RCW 43.21A.064(2).

David Cummings, P.E.
Structural Specialist
Dam Safety Office
Water Resources Program

W. DAVID CUMMINGS
STATE OF WASHINGTON
25357
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 7/25/2005

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LITTLE FALLS DAMS
Periodic Inspection Report

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Little Falls Dam, Little Falls Spillway Dam
Periodic Inspection Report

1. Introduction

Under state law (RCW 43.21A.064(2)), the Department of Ecology has responsibility and authority to inspect the construction of all dams and other works related to the use of water, and to require necessary changes in construction or maintenance to reasonably secure safety to life and property. This report has been prepared in accordance with this statute.

The report presents the results of the second periodic inspection and safety evaluation of the Little Falls Dam [1] and Little Falls Spillway Dam [1] by the Ecology Dam Safety Office (DSO). The report provides:

- Background information,
- A description of the project,
- Results of the October 23, 2002 inspection,
- Engineering evaluation and analyses of the design of the project,
- Required remedial actions based on the findings from the current inspection

2. Background Information on the Project

2.1 General

The Little Falls Dam is located on the Spokane River (at river mile 29) in Lincoln County, 25 miles northwest of the city of Spokane (Figure 1). The facility is owned and operated by the Avista Corporation and is used for hydroelectric power generation. The dam and power plant are a "run of the river" project [2]. The project stores 2,220 acre feet of water at normal pool.

The Washington Dam Safety Office considers the project two dams, separated by a rock outcrop between the south end of the Spillway Dam and the buttress section of the Forebay Dam (Figure 3). The Forebay Dam is U-shaped in plan, with components on the west, south, and east sides, and is located immediately above the powerhouse. The powerhouse has 4 penstocks penetrating the north wall, which pass through the

1 This document will include both the Little Falls Dam and the Little Falls Spillway Dam in report discussions as the Little Falls Dam, unless specifically noted.

2 The project relies primarily on in-stream flows, rather than the release of water stored in the reservoir.

intake section of the project. The total crest length of the Forebay Dam is 850 feet. The Forebay Dam is a concrete gravity structure with a maximum hydraulic height of 54 feet, and a crest elevation of 1364.0 feet. The concrete gravity section was constructed using cyclopean concrete, consisting of large granitic boulders imbedded in a regular concrete matrix.

The Spillway Dam at Little Falls consists of a 597 foot long concrete gravity structure. The dam is constructed in an "L" configuration, with a 75 foot long non-overflow section at the south end, and a 70 foot long section with two radial gates at the northeast left abutment. The crest of the overflow section has an ogee weir shape, with a maximum height of about 64 feet above bedrock. The overflow section is provided with a row of 6 foot high timber flashboards, which are provided to maintain the forebay pool elevation at 1362.0 feet. The gated spillway consists of two, 20 foot wide concrete weirs fitted with steel tainter-type radial gates. The weirs have a crest elevation of 1341 feet, while the top of the gates are at Elevation 1365 feet.

2.2 History

The Little Falls site construction began in 1908. The first unit went online on June 1, 1910, and the project was completed in 1911 with installation of unit number four. According to Avista staff, the project was raised six feet in the 1940's.

A major rehabilitative work was begun in 1998, starting with painting of the penstocks. Stability-related improvements were made in 1998 and 1999 to the Forebay Dam. The intake deck, trashracks, and support structure were replaced in 2001. A complete list of improvements and major maintenance can be found in Appendix E, Hydro Activities Summary.

2.3 Geology

2.3.1 General Site Description and Geologic Overview[3]

The setting is typical of eastern Washington drainage channels that owe their morphology to the events of the late Pleistocene glacial Lake Missoula outburst floods (Bretz, 1923). The Missoula Floods (the last of which occurred between --11,000 and 13,000 thousand years ago) resulted from the repeated catastrophic release of water impounded by a lobe of the continental ice sheet that periodically dammed the Clark Fork River, forming Lake Missoula in what is now Montana. The result of these

3 Gerstal, Wendy, Licensed Engineering Geologist, Washington Dept. of Natural Resources; "Little Falls Dam Geologic Investigation: Memo To Doug Johnson, David Cummings, Washington Dam Safety Office," February 28, 1995.

floods is a network of anastomosing channels scoured into bedrock, and subsequently filled in places by giant river bars and incised terraces of sand, gravel, and boulders. The Spokane River occupies one of the deep channels.

Surrounding Little Falls the effects of the giant floods are visible as cliffs of Columbia River basalts overlying rounded hills and channel beds of igneous rocks (primarily granodiorite). Superimposed on the bedrock are the fluvial terraces and flood bars left behind by the Missoula Floods. Approaching the dam site on Little Falls Road from state highway 231 to the east, one travels down through some of these Pleistocene flood deposits.

2.3.2 Bedrock foundation of the Dam

Lithology - The Little Falls Dam is constructed on granodiorite, which is exposed in and along the channel margins of the Spokane River at Little Falls. The bedrock is correlated to the Cretaceous medium-coarse-grained granodiorite near Wellpinit (90-115 million years old)(Joseph, 1990), and also includes syenite, monzonite, and diorite. This rock unit contains 25-30% quartz, with lesser amounts of feldspar, biotite, and hornblende. In the area under the intake the granodiorite contains mafic inclusions up to 5-10 cm in diameter. In places it is cut by aplite and pegmatite dikes of a variety of orientations and thicknesses, from a few centimeters to > 1 m. A few of the dikes are clearly visible in the stream channel below the spillway and below the old bridge.

Jointing - Sets of intersecting joint planes give bedrock exposures a blocky appearance. Joint spacing ranges from less than a few centimeters to several meters with the average spacing approximately 0.5-1.0 m. In some areas of the site, such as below the spillway, dikes both cross-cut and parallel the joints. Most of the joint plane surfaces are fresh, with none of the characteristics, such as slickensides, (mylonitic) mineralization, gouge clay, etc., that indicate movement of one block relative to its neighbor. The exception occurs under the intake dam where some of the joint surfaces are coated with epidote and chlorite and have minor slickensides, but no gouge. The epidote/chlorite mineral assemblage, however, is characteristic of the metamorphism and unroofing of intrusives that commonly occurred in NE Washington during the Eocene (57-36 million years ago). It implies a different hydrothermal regime from today and suggests that the formation of the joint system, and movement along joint surfaces, may be associated with the Eocene metamorphism and has therefore been stable since that time.

Alteration - A small zone of potential weakness along joint boundaries also occurs under the intake dam, just below one of the intake pipes on the east side of the dam. Here several of the closely-spaced joint surfaces show iron staining and some disintegration of the rock along mineral grain boundaries. There is no evidence of secondary clay mineralization associated with these zones. The iron-staining seems to correspond to points of slow seepage of water from the dam that have occurred over a long period of time; however, it is unclear whether the iron is leaching out of the reinforced concrete dam or the bedrock.

2.3.3 Seismicity[4]

Little Falls Dam is situated in the Palouse Subprovince of the Columbia Plateau near its contact with the Omineca Crystalline Belt Subprovince. The Palouse Subprovince "*is characterized by gentle folding*[5]. Geologic features postulated as potentially active in the Palouse and adjacent Omineca Subprovince are all many tens of kilometers from the dam. Thus, present estimates of the peak accelerations at the site for a given exceedance probability are controlled by assumptions as to the magnitude-frequency relationship assigned to random crustal earthquakes in the two abutting subprovinces.

The 1990 Geomatrix Study assigned a maximum magnitude random crustal event within the Palouse Subprovince on the order of M_w 6.5. This represents an event with an annual exceedance probability of 0.00005 (20,000 year recurrence interval)6. The National Earthquake Hazards Reduction Program (NEHRP) Maps consider an M_w 7 event as a likely upper bound for random crustal earthquakes throughout the region. The NEHRP peak acceleration maps also incorporate attenuation relationships that reflect the considerable increase in strong motions data acquired in the decade and a half since the 1990 Geomatrix study. Utilizing the October 2003 NEHRP gridded seismicity tables[7], the mean peak accelerations predicted for the site is 0.16 g at an exceedance probability of 2% in 50 years (recurrence interval 2475 years). Their predicted peak seismic accelerations come almost exclusively from crustal events at hypocentral distances of less than 25 kilometers.

Due to the low seismicity of the project setting and relatively low downstream hazard setting of the dam, development of a site-specific response spectrum or synthesizing of ground motions for input for a time history analysis was deemed unnecessary.

3. Field Inspection of the Facility

The field inspection of the Little Falls Dam was performed on October 23, 2002. The Dam Safety inspection team consisted of the following personnel:

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4 LaVassar, Jerald, Washington Dam Safety Office; Little Falls Dam: Memo To File, March 19, 2004.
5 Geomatrix Consultants. (1990). Seismotectonic Evaluation of the Walla Walla Section of the Columbia Plateau Geomorphic Province, U.S. Department of Interior Bureau of Reclamation, p. 11.
6 Ibid., p. 79, (Figure 4-8).
7 ftp://ghtftp.cr.usgs.gov/pub/hazmaps/data2002/ascii/USpga2500v6.asc

Name	Aspects Covered
David Cummings, P.E.	Coordinator, Structural
Martin Walther, P.E.	Hydrology/Hydraulics
Parris Phelps	General Inspection

The dam owner, Avista Corporation, of Spokane, Washington, was represented by the following individuals:

Name	Aspects Covered
Dave Eastwood	Plant Superintendent
Steve Fry, P.E.	Hydro Safety Administrator
Mitch Veltri	Generation Maintenance General Foreman
Gary Walter	Civil Engineering Technician
John Hamill, P.E.	Production Engineer/Project Engineer

3.1 Reservoir

Little Falls Dam reservoir has a surface area of 250 acres at the normal pool elevation of 1364.0 feet. Since the dam impounds only about 2220 acre-feet at normal pool, it is considered a run-of-the-river project. According to Avista, the historic low pool level is 1351.0 feet.

3.2 Concrete Dam

3.2.1 Forebay Dam

Concrete condition - The concrete surface of the downstream face of the Forebay Dam is extremely varied. Minor weeping is taking place in a number of areas. Small depressions have provided toeholds for vegetation to grow. While it appears an effort was made to form the exterior face during the original construction, the resulting surface is somewhat "lumpy." However, the concrete appears to be durable and certainly functional, although of rugged appearance in a number of areas.
A vertical structure near the SE corner of the intake section appears to be a joint, although attempts to locate the joint detail in the set of plans in the project file were unsuccessful. The "joint" was leaking 5-10 gpm at the time of inspection. In addition, grass and other small vegetation was taking root in the joint-like structure.
The entire Forebay crest has been leveled off to a uniform 1364.0 feet, except for a small portion of the Wingwall section. This work was performed in the 1998 stability improvements. The new Forebay crest concrete has a few transverse shrinkage cracks that date back to the time of original construction (1998). No other dam safety-related irregularities were observed in this area other than cosmetic ones discussed above.

There were no observable signs of structural distress or movement. Any visible damage or irregularity was related to either freeze-thaw action or poor bond at a horizontal joint.

3.2.2 Spillway Dam

In March of 1994, the Dam Safety Section inspected the downstream toe and face of the spillway dam. Since water was leaking through the flashboards, it was obscuring a determination of whether water was flowing from under the spillway toe or not. At the time of the September 1994 inspection, the area below the flashboards was temporarily placed out-of-bounds by Avista for safety reasons. According to Avista, hydropower unit shutdowns can cause surges that knock down the flashboards, suddenly releasing the 5 feet of impounded water behind the flashboards. This unplanned release could injure someone in the river channel below.

Later in 1995 when the flashboards were not in place, Avista staff toured the toe area of the Spillway dam and submitted photos for our files. The photos were inspected and no signs of water flowing from under the Spillway Dam could be detected. When an attempt was made to access this area in the 2003 inspection, we were again informed that the area was out-of-bounds due to the flashboard installation. It is not known if Avista staff have inspected the Spillway Dam toe area since.

The concrete surface of the downstream face of the Spillway Dam is also variable. This is probably due to the cyclopean concrete construction method. Thin concrete cover between formwork and embedded granite boulders has probably spalled off, resulting in an exposed granite surface. This boulder surface is not smooth or flat and could be what gives rise to the surface appearance in some areas of the concrete dam.

Panel lines from forming the exterior face are more obvious in this area, but the surface is “lumpy” here too. The concrete appears to be durable in spite of a more aggressive freeze-thaw exposure than that endured by the Forebay Dam. There were no observable signs of structural distress or movement at the time of the inspection. Any visible damage or irregularity was related to either ongoing freeze-thaw action or slight misalignments from the original 1920-era concrete construction.

3.3 Spillway

The Spillway Dam crest has wooden flashboards installed that raise the pool 5 feet. A pivot mechanism with a release cable drops the flashboards. A pool level slightly above the base of the flashboards was being maintained at the time of our inspection. No attempt was made to inspect the flashboards or Spillway Dam overflow section, other than a visual observation from the Spillway Dam abutments. The use of temporary wooden flashboards does present some risk to public safety, since a sudden failure due to a reservoir surge (from the unit shutdown discussed above) could send a flood wave into the dry river channel below the spillway dam. Avista has placed warning signs around the area to discourage public access.

The wooden flashboards are replaced new each time they are pulled, so deterioration or damage should not be a consideration in the life of these appurtenances. It might be possible for the pivot structure at the base of the flashboard to be damaged by logs or debris impacting the flashboard base, but this could probably be determined at the time that new boards are installed. Since Avista does not allow public or worker access below the flashboards, condition of the flashboards is more of a maintenance item for Avista, rather than a safety issue that should be addressed herein.

3.4 Radial Gate Structure

The Little Falls Dam has a gate structure at the left abutment of the dam. Mounted within this structure are two 24 x 20 foot tainter gates. During this inspection, the gate girder, steel struts, and gate hoists were inspected, but the gates themselves were not operated. The downstream view of the gates revealed no corrosion, bent struts, or obvious damage or misalignment of the gates. There was no vantage point where the upstream face of the gate skins could be inspected. According to Avista, the gates are opened annually and emergency power is available to the gates for opening purposes.

During this inspection, Avista staff were discussing performing tests in the future to calculate the gate friction, trunnion torque, and performing a structural analysis of the individual steel struts and beams. It is not known whether that has been completed or not.

3.5 Penstocks

According to Avista, the penstocks were repainted in 1998. The penstocks appeared to be in good condition at the time of the inspection. The paint has suffered only slight, localized discoloration from rusting since 1998. There were no signs of significant corrosion, denting, or any signs of structural distress.

Avista has a Penstock Inspection Program for the Little Falls project. The Inspection Plan describes the project with particular emphasis upon the penstocks. Inspections are described as well as failure modes for the penstocks, encouraging close attention to particular details.

According to the inspection program, the penstocks are inspected every five years. A copy of the Penstock Inspection manual for this project as well as copies of the completed inspection forms from the 2002 inspection are in Appendix D. The inspection forms describe minor amounts of leakage and some small concrete spalls or cracks in surrounding concrete.

4. Evaluation and Analyses

4.1 Downstream Hazard Classification

It is common practice to use a classification system to describe the general level of development downstream from a dam, which could be affected by a flood should the dam fail. This classification is used for selecting minimum design levels for the various elements of the facility, such as the flood used to design or analyze the spillway(s). Table 1 below lists the classification system used by the Dam Safety Office.

Table 1. Downstream Hazard Classification

Downstream Hazard Potential	Downstream Hazard Classification	Column 1A Population at Risk	Column 1B Economic Loss Generic Descriptions	Column 1C Environmental Damages
Low	3	0	Minimal. No inhabited structures. Limited agriculture development.	No deleterious materials in water
Significant	2	1 to 6	Appreciable. 1 or 2 inhabited structures. Notable agriculture or work sites. Secondary highway and/or rail lines.	Limited water quality degradation from reservoir contents.
High	1C	7 to 30	Major. 3 to 10 inhabited structures. Low density suburban area with some industry and work sites. Primary highways and rail lines.	
High	1B	31-300	Extreme. 11 to 100 inhabited structures. Medium density suburban or urban area with associated industry, property and transportation features.	Severe water quality degradation potential from reservoir contents and long-term effects on life.
High	1A	More than 300	Extreme. More than 100 inhabited structures. Highly developed densely populated suburban or urban area.	

As part of the 1995 inspection, the Downstream Hazard Setting was reviewed with the following finding[8]:

"As part of this inspection, the downstream hazard potential was reassessed. This was accomplished by a visual inspection of the downstream valley, and with topographic maps and dam breach inundation maps provided by WWP (Avista). Downstream from the Little

[8] Periodic Inspection of Little Falls Dam; Washington Dam Safety Office, Olympia, WA; February 1995.

Falls Project, the Spokane River flows through a deeply incised valley for 29 miles until it enters the Columbia River. This stretch off the river is backwatered by Lake Roosevelt, which is formed by Grand Coulee Dam on the Columbia River. There are no inhabited structures on this stretch of the Spokane River that would be affected by a failure of either the Spillway Dam or the Forebay Dam. However, the failure of the Forebay Dam would inundate the powerhouse, and wash over the Little Falls highway. While there is some chance for loss of life (dam safety risk analysis deals with reasonable expectations, like permanent occupancy of a structure within the inundated area), <u>the main effect of a failure of the Forebay Dam would be economic, due to damage to the powerhouse and power generating equipment.</u>

4.1.2 Dam Break Analysis

A theoretical failure of the dam was modeled in 1993 by Dr. M. Hanif Chaudhry. He considered the project as shown in the design plans, with the following assumptions in the analysis:

<u>Analysis Assumptions</u>
Breach Width – 185 feet
Bottom of Breach – Dam Bottom (Foundation Rock)
Side Slope – 0.0 (Vertical)
Exponent for Breach Development – 0.1 (Linear)
Time for Breach Development – 0.1 Hr.

River Channel – 30 Cross Sections Using US Dept of Interior maps and Avista measurements.

Mannings “n” – 0.030 (0.038 near dam)

<u>Antecedent Flow Conditions Utilized in Analysis</u>
Low Flow – 100 cfs
Max Plant Discharge – 7500 cfs
Flood of Record – 49700 cfs
High Flow – 79900 cfs

<u>Results of Dam Breach Study</u>
The flood wave generated by a failure of the Little Falls Dam is dissipated to less than one foot by the time it reaches the confluence with the Columbia River 29.3 miles downstream. Accordingly, little risk is perceived to Grand Coulee Dam with a maximum lake level of 1289.0 and a crest elevation of 1311.0 (freeboard of 22 feet).

Based on these findings, no homes are potentially at risk from a failure of either the Little Falls Spillway or Forebay Dams. The dam break flood from a failure of the Forebay Dam would damage the powerhouse and power generating equipment. In addition, the powerhouse is occupied at least 12 hours a day and the safety of at least one operator should be considered in the hazard rating. Therefore, the hazard classification for the Little Falls Spillway Dam should remain **Hazard Class 3, *Low*** Downstream Hazard and the Little Falls Forebay Dam should remain **Hazard Class 2, *Significant*** Downstream Hazard.

4.2 Hydrology and Spillway Adequacy

Avista consultants have performed several analyses to determine that the Inflow Design Flood for the Little Falls Dam is "approximately 73000 cfs."[9] At the same time, Avista affirmed that the spillway capacity at the project is approximately 73000 cfs and results in a reservoir elevation of 1364.0.

There is a high degree of uncertainty involved in computing the inflow design flood for this facility, given the number of regulated reservoirs upstream and large drainage basin. With this complexity in mind, the Dam Safety Office and Avista agreed to focus their efforts on stabilizing the structure instead, using an agreed-upon IDF and spillway capacity of approximately 73,000 cfs. Dam Safety's viewpoint was that there was little to gain by disputing the point and recognizing 1) the concrete dam with rock abutments can sustain some amount of overtopping by flood waters in excess of spillway capacity, and 2) the relatively low downstream hazard of the structure. Therefore, the current spillway capacity at the Little Falls project is considered adequate.

4.3 Concrete Dam Stability

As part of the 1995 inspection reports by Avista and the Dam Safety Office, the stability of all concrete dam sections were evaluated for sliding, overturning, and stress levels. The three typical load cases were evaluated: 1) hydrostatic water loads caused by typical water levels, 2) hydrostatic loads from the Inflow Design Flood, and 3) lateral loading from a (coefficient-type static equivalent) seismic event. Results were satisfactory for all load cases for the Spillway Dam. Results were satisfactory for all load cases for the Forebay Dam except for load case #2, Inflow Design Flood. This load case was evaluated in 1998 and 2000 for the sections of the Forebay Dam: Buttress and Wingwall (1998), and Intake (2000). A range of solutions for different dam cross sections, involving post-tensioned anchors, a concrete cap for additional weight, and concrete toe buttress were recommended. The work specified in the consultant's recommendations was completed in 2000. No further stability analyses are required at this time.

4.4 Operation & Maintenance

Avista has a written Operation and Maintenance (O&M) Plan entitled "Operation Plan for Little Falls Hydroelectric Development. The date of the plan in the Dam safety Office files

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[9] Little Falls Dam File, Letter from Steve Fry, Washington Water Power (Avista) to Douglas Johnson, Ecology Dam Safety Section; November 30, 1995

is August 1994. The plan describes the Little Falls project and lists significant features lengths, heights, capacities, etc. In addition, Project Monitoring and Normal Operating Procedures are discussed in concept without identifying details, intervals, and key personnel performing the work described. It is likely that this report has been updated and the Dam Safety Office does not possess the latest copy.

4.5 Emergency Preparedness

The Dam Safety Office has on file the current Emergency Action Plan for Little Falls Dam. The Plan has been updated annually and complies with the requirements of Chapter 173-175 WAC, section 520 Emergency Action.

5. *Conclusions and Required Remedial Actions*

Based on our inspection, the Little Falls Dam is a well constructed and well-maintained structure. Both dams meet current standards for withstanding floods and extreme loading conditions. However, the following issues of project operation need to be resolved:

5.1 Spillway Dam Toe Inspection

Since the Dam Safety Office was not able to inspect the toe of the Spillway Dam during the 2002 inspection, please submit to this office a record of Avista's last inspection of the toe area. If the last inspection of this area was that performed in 1995, the area needs to be re-inspected and documented via photographs. Photos from any new inspection need to be submitted to us for our review.

5.2 Operation and Maintenance Plan

The Operation and Maintenance Plan for the Little Falls Dam needs to be updated. Ideally, the latest plan will include:

- A listing of procedures involved in operation of the dam, and the person(s) responsible for performing them.
- Procedures for the owner to conduct monthly and annual inspections of the dams.
- Routine maintenance activities that must be performed regularly, such as debris removal from the log booms and intake, and grass and brush removal from depressions and joints, gate operation and flashboard installation.
- Routine monitoring and recording of previously identified seepage flows through cracks, poorly bonded construction joints, etc.

Additional information to assist in completing the revisions to the Operation Plan are contained in Ecology Publication No. 92-21, *Guidelines for Developing Dam Operation* *and Maintenance Manuals.* The updated Operation Plan must be submitted to the DSO within 180 days following issuance of this report, as required in WAC 173-175-510.

Appendix A - References

1. Petrographic Examination of a Sample of Concrete and Foundation Rock, Little Falls Dam, State of Washington; Mielenz, Richard C.; Gates Mills, OH; March 1979.

2. Structural Analyses of Little Falls Dam; Bovay Engineering; Spokane, WA; 1980.

3. PMF Study for the Post Falls, Nine Mile, and Long Lake Hydroelectric Developments; Ebasco Services; Seattle, WA; August 1987.

4. Rating Curves For The Spillway of Little Falls Dam Hydroelectric Development, M. Hanif Chaudhry, Ph.D, Pullman, WA; December 1993.

5. Backwater Curves For The Little Falls Dam Hydroelectric Development, M. Hanif Chaudhry, Ph.D, Pullman, WA; December 1993.

6. Inundation Due To Dam Breach At Little Falls Dam Hydroelectric Development, M. Hanif Chaudhry, Ph.D, Pullman, WA; December 1993.

7. Operation Plan For Little Falls Dam H.E.D.; Washington Water Power (Avista Corp.); August 1994.

8. Little Falls Flood Frequency Review, Raytheon Engineering & Constructors; October 1994.

9. Little Falls Hydroelectric Development: Geologic and Seismic Considerations; Washington Water Power (Avista Corp.); January 1995

10. Inspection of Project Works: Little Falls Hydroelectric Development; Washington Water Power; Spokane, WA; June 1995.

11. 1996 Geotechnical Exploration and Testing Program: Little Falls Hydroelectric Development; Raytheon Infrastructure; Seattle, WA; April 1997.

12. Preliminary Design Report: Little Falls Stability Improvements, Phase One; Thomas, Dean, & Hoskins; Spokane, WA; April 1998.

13. Periodic Inspection of Little Falls Dam; Washington Dam Safety Office, Olympia, WA; February 1995.

14. Geologic Investigation of the Little Falls Dam Site, Lincoln County, Washington; Wendy Gerstal, Washington Dept. of Natural Resources; February 1995.

15. Little Falls HED 1998: Stability Improvements Construction Report, Avista Corp., Spokane, WA; March 1999.

16. Emergency Action Plan: Little Falls Dam; Avista Corp.; Spokane, WA; January 2000 (Updated Annually).

17. Preliminary Design Report: Little Falls Stability Improvements, Phase Two; Thomas, Dean, & Hoskins; Spokane, WA; January 2000.

18. Little Falls HED 2000: Stability Improvements Final Construction Report, Avista Corp., Spokane, WA; July 2000.

Appendix B - Figures

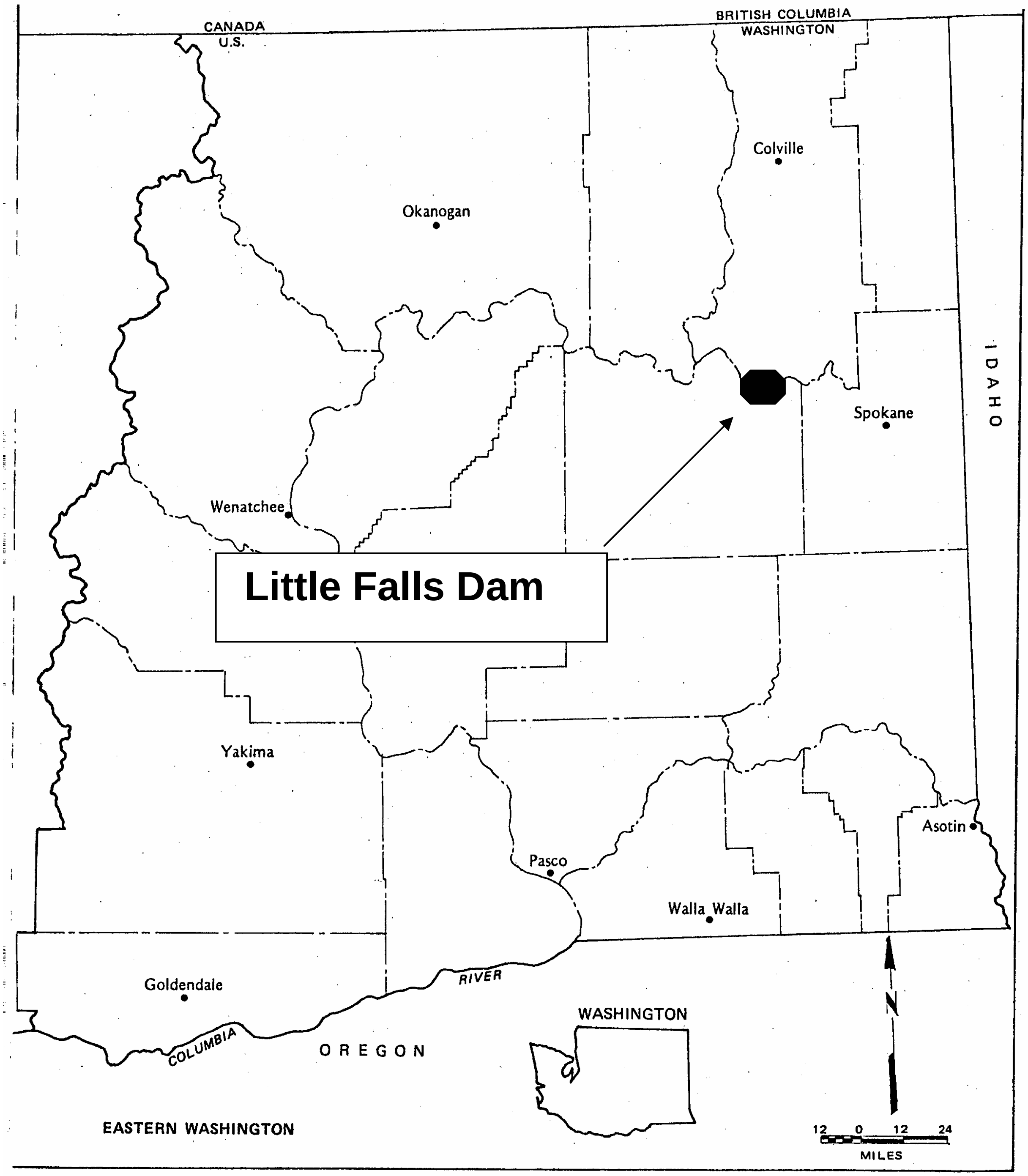

Figure 1 – Location Map

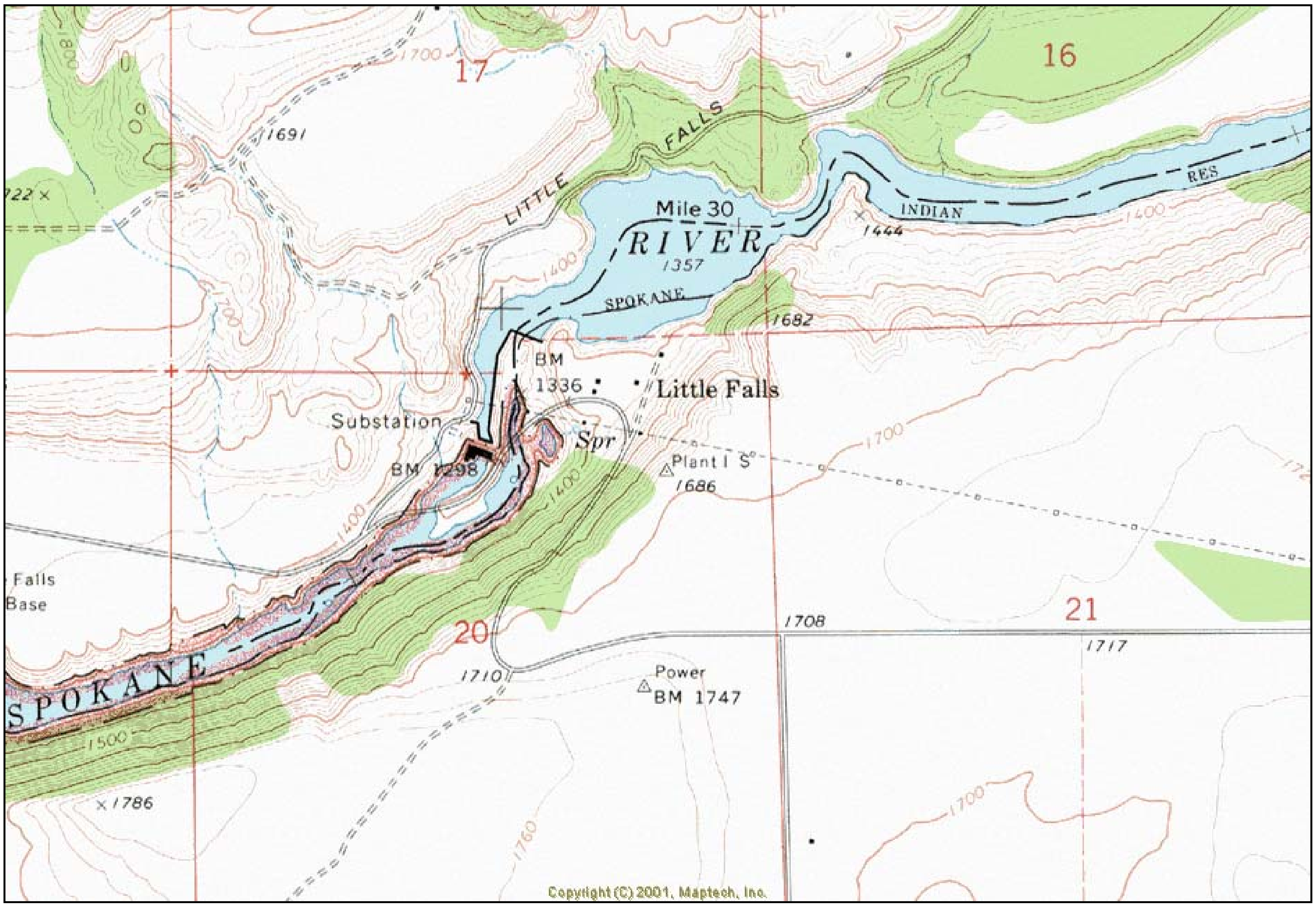

Figure 2 – Vicinity Map

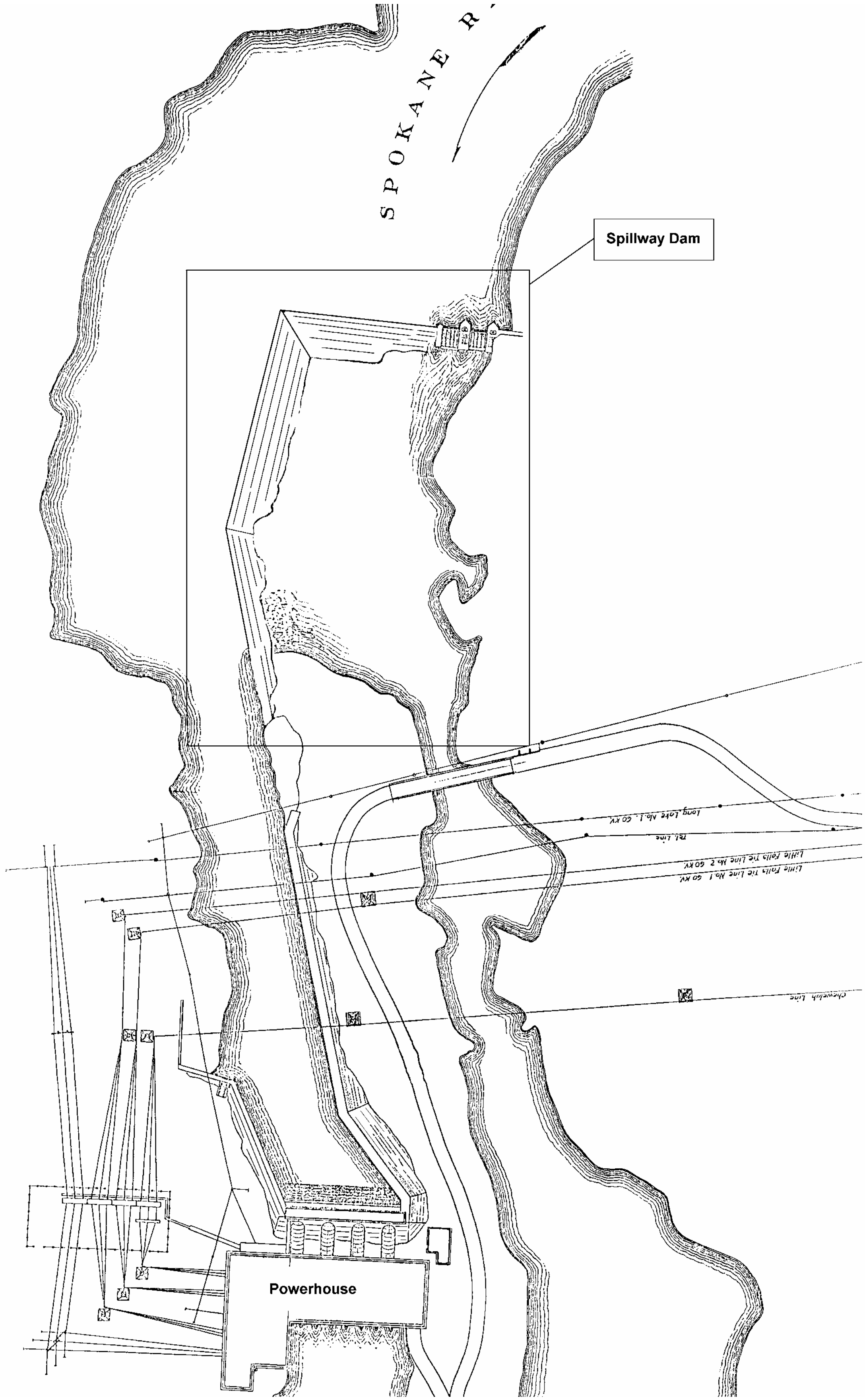

Figure 3 – Little Falls Forebay & Spillway Dams, Site Layout

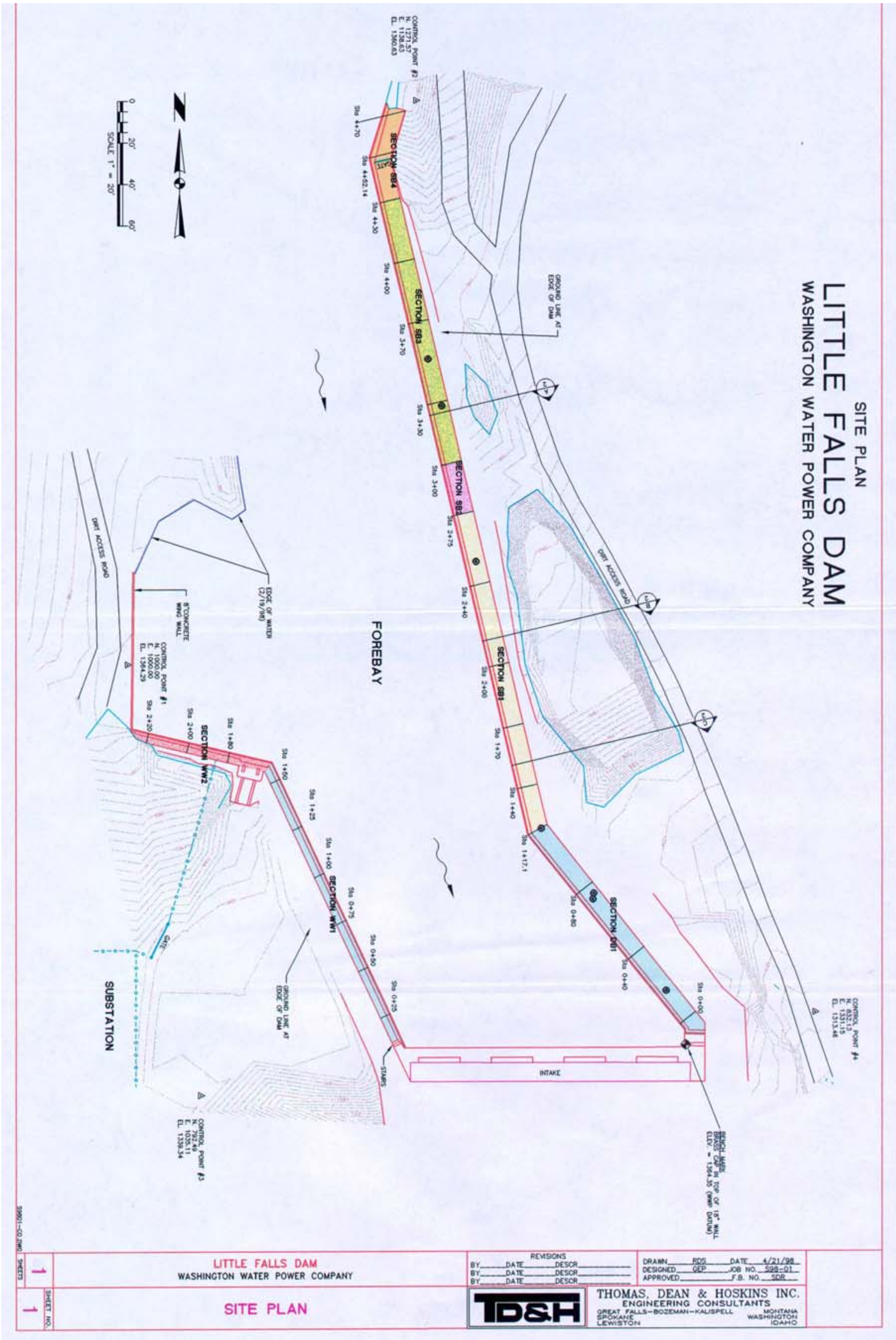

Figure 4 – Forebay Dam Layout, 1998 & 1999 Mod. (Intake)

<u>Little Falls Dam Figure Index</u>

Spillway Dam & Forebay Dam

- **Sections Not Modified in 1998 or 1999**

  Penstocks – Fig 5

  Spillway – Fig 6

- **Sections Modified in Stability Improvements 1998 & 1999 (From Figure 4)**

  Buttress Sections
  - **DB1 – Fig 7**
  - **SB1 – Fig 8**
  - **SB2 – Fig 9**
  - **SB3 – Fig 10**
  - **SB4 – Fig 11**

  Intake Section – Fig 12 & 13

  Wingwall Section
  - **WW1 – Fig 14**
  - **WW2 – Fig 15**

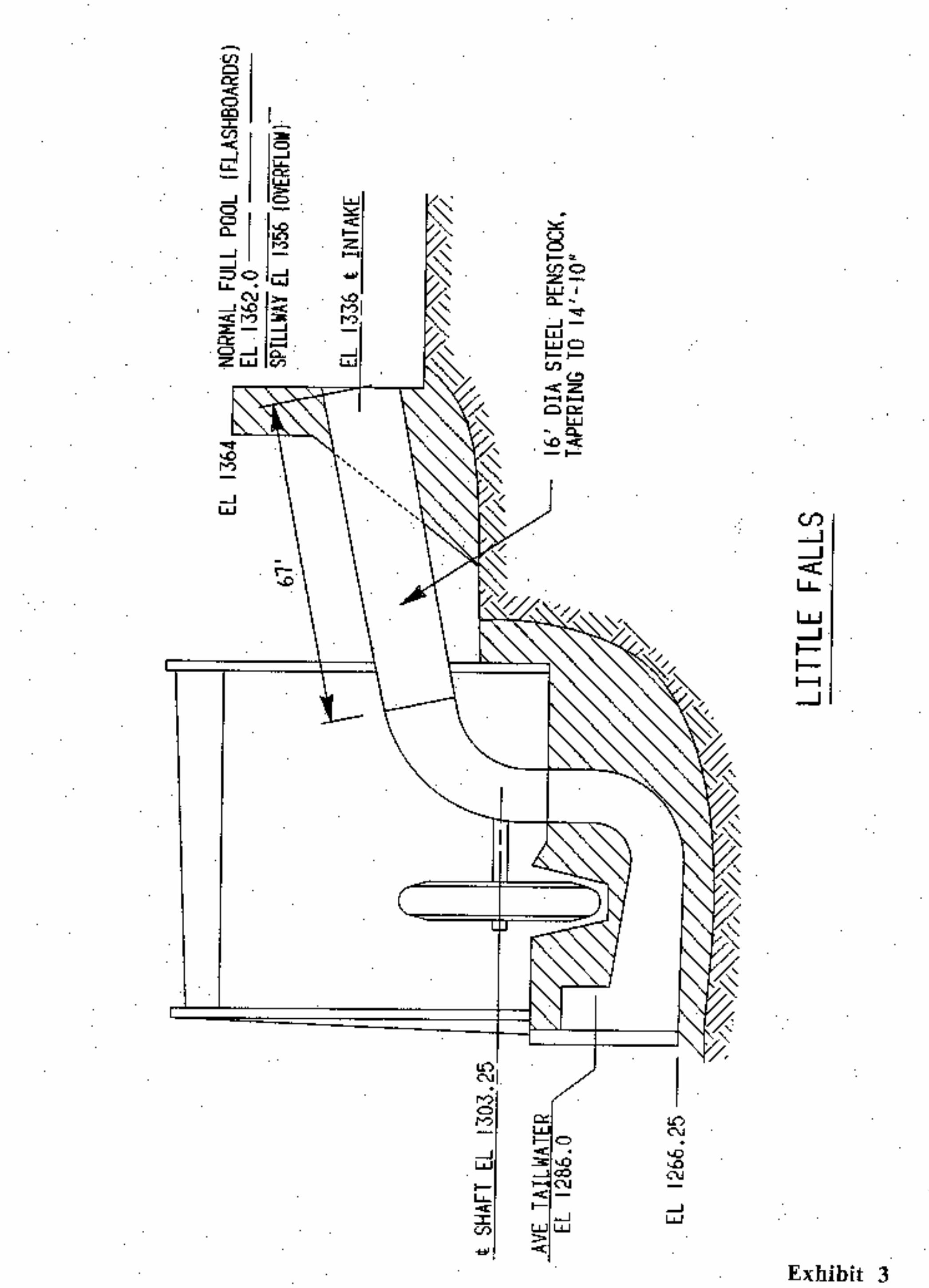

Figure 5 – Project Penstock (Typ.)

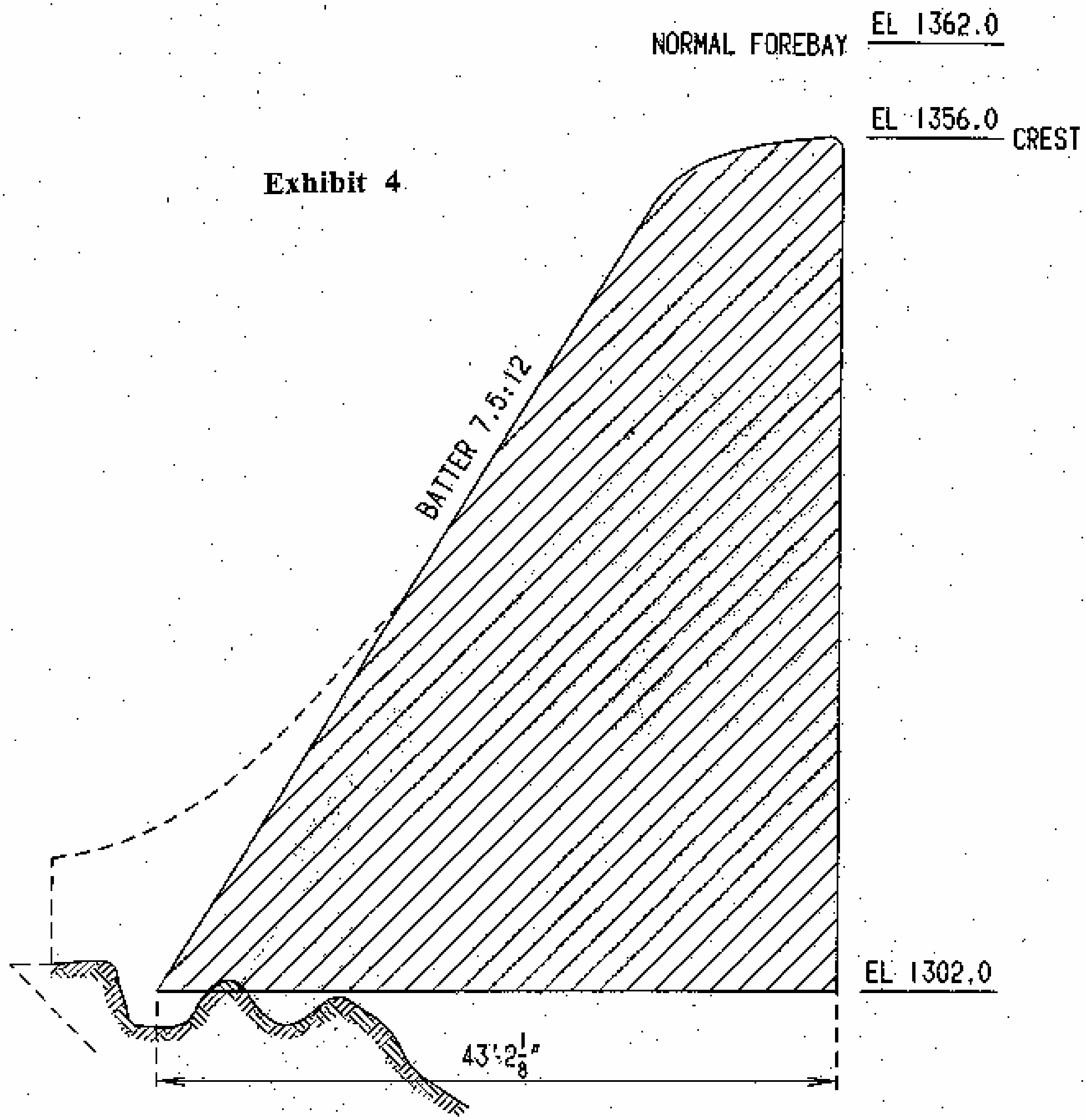

Figure 6 – Spillway Dam Cross Section

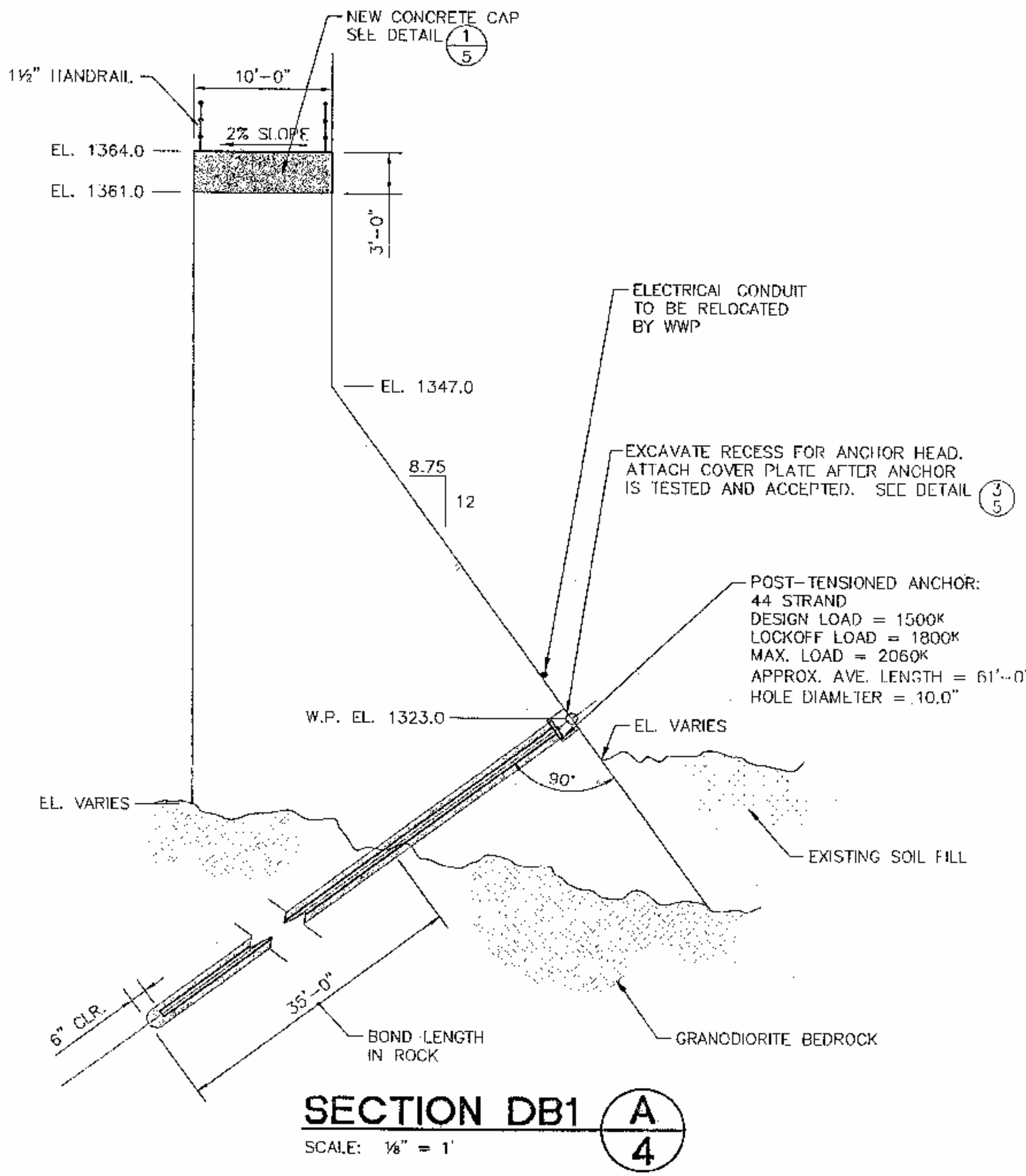

Figure 7 – Buttress Section DB1

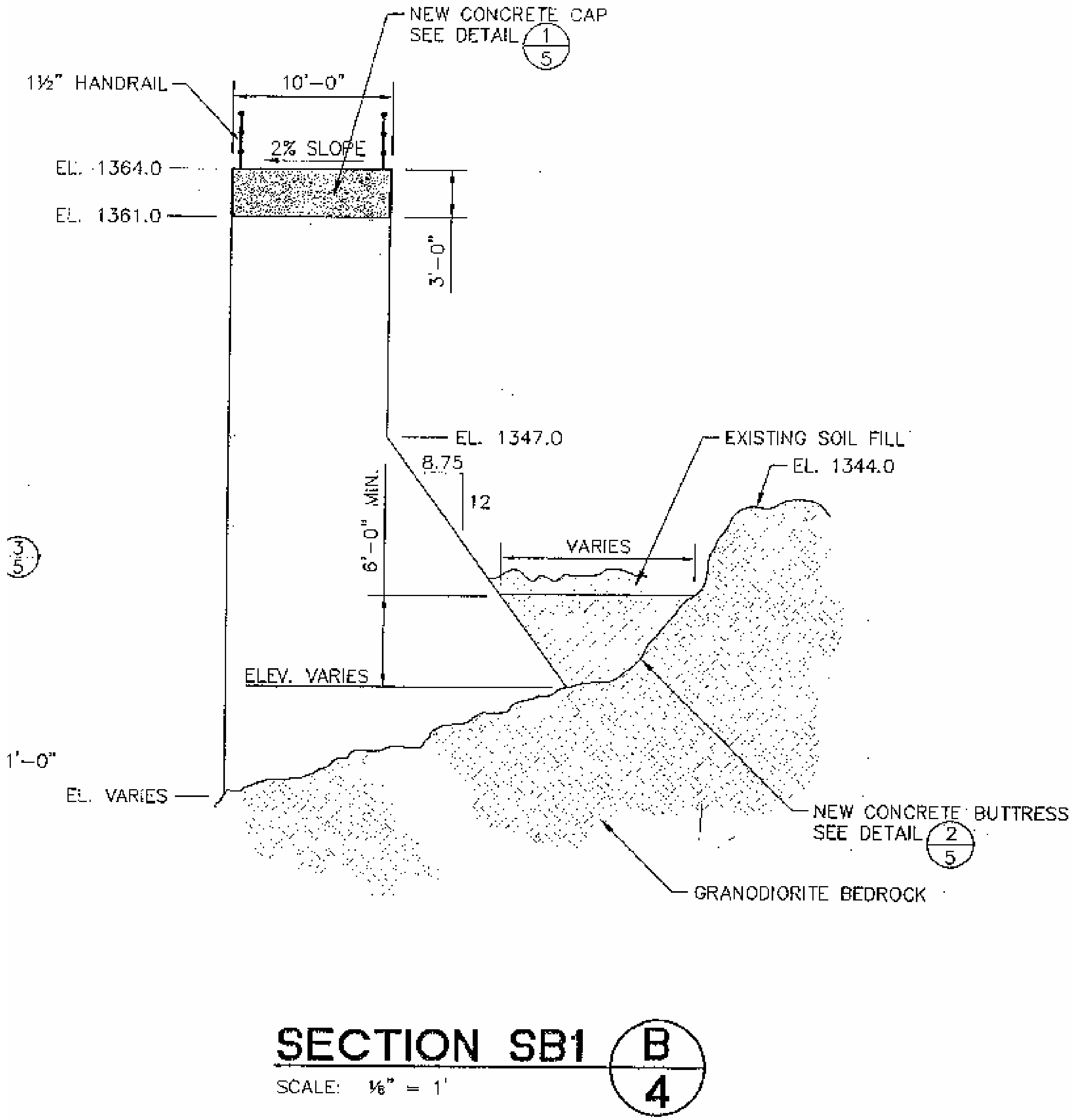

Figure 8 – Buttress Section SB1

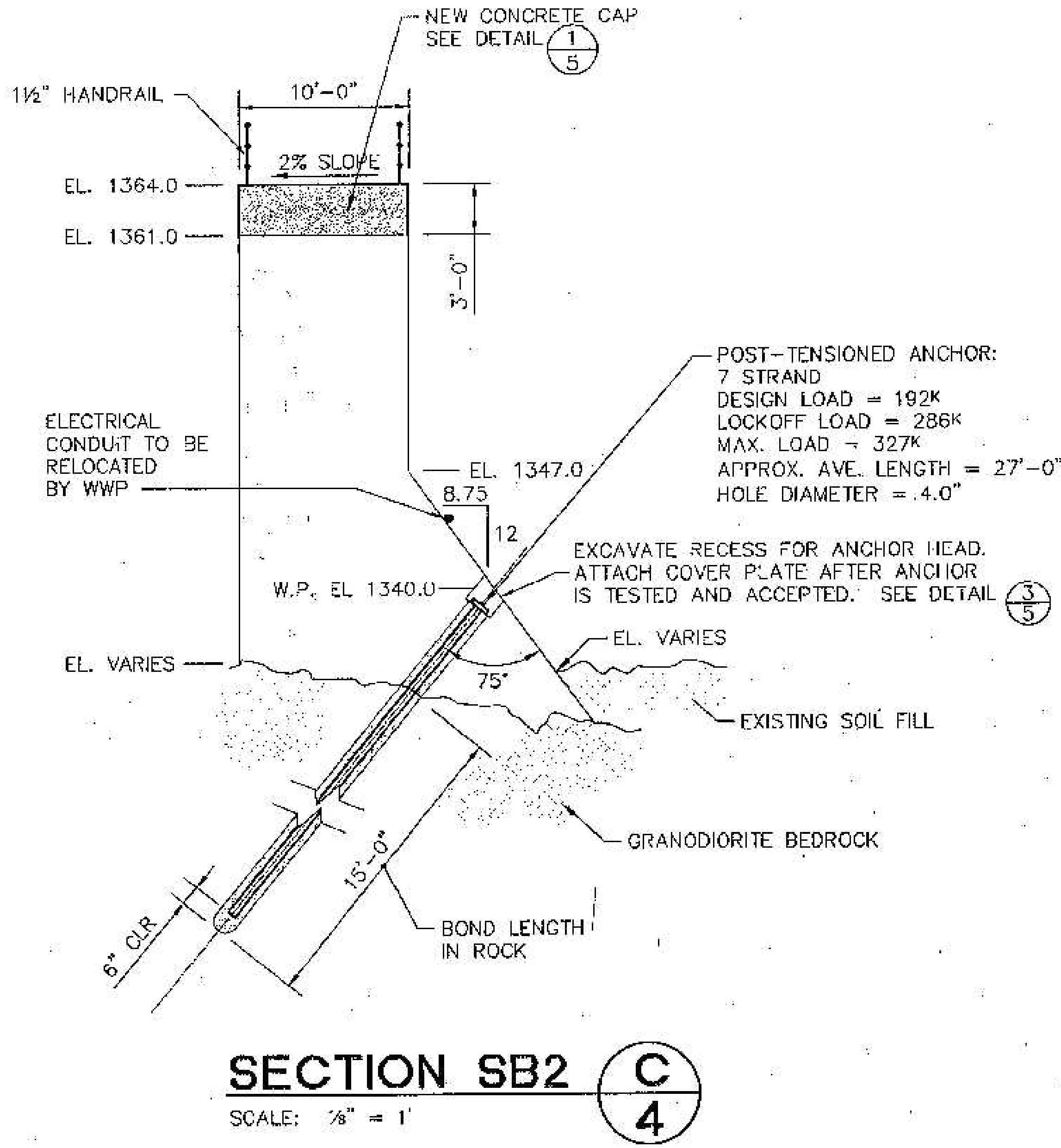

Figure 9 – Buttress Section SB2

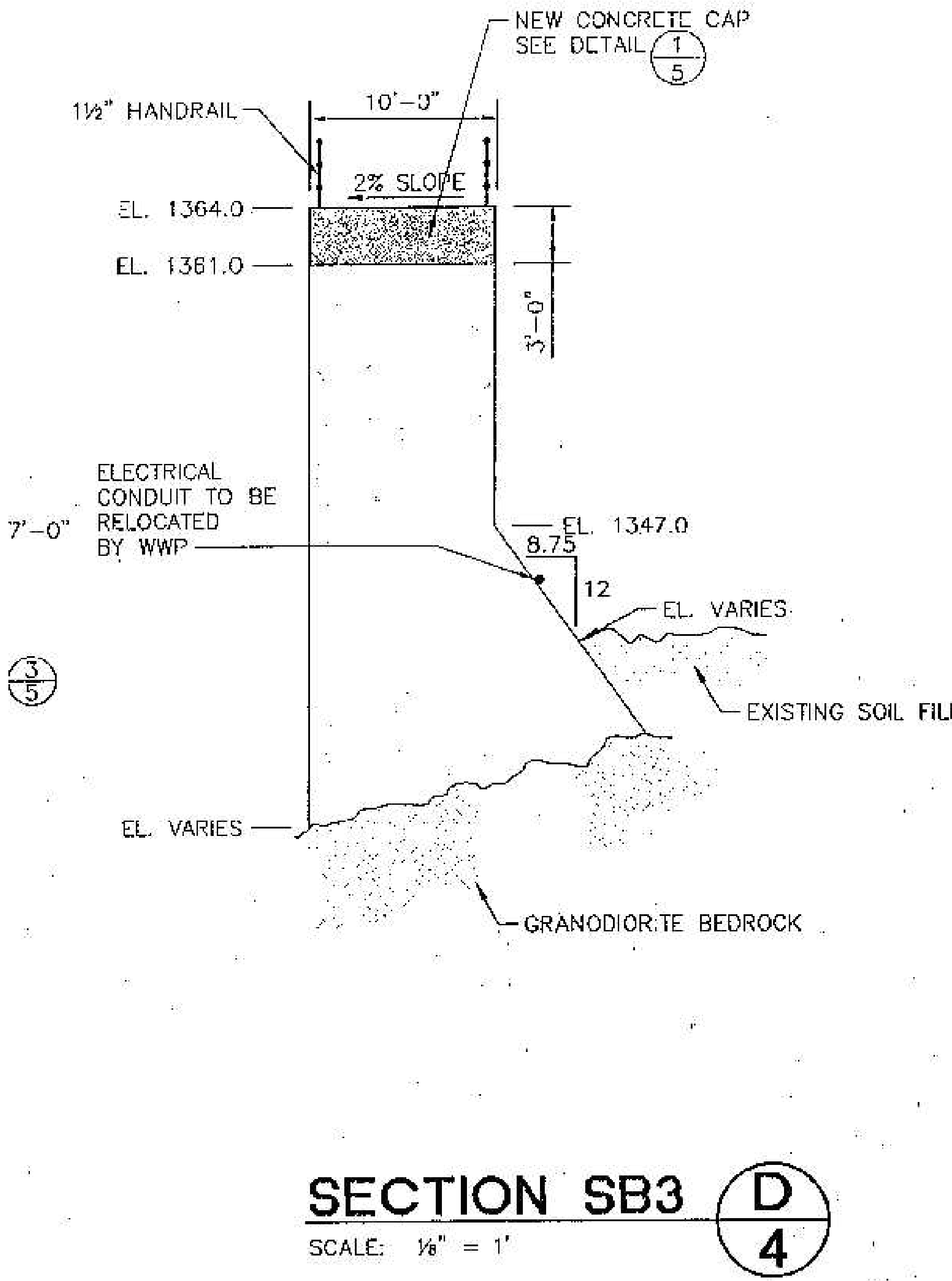

Figure 10 – Buttress Section SB3

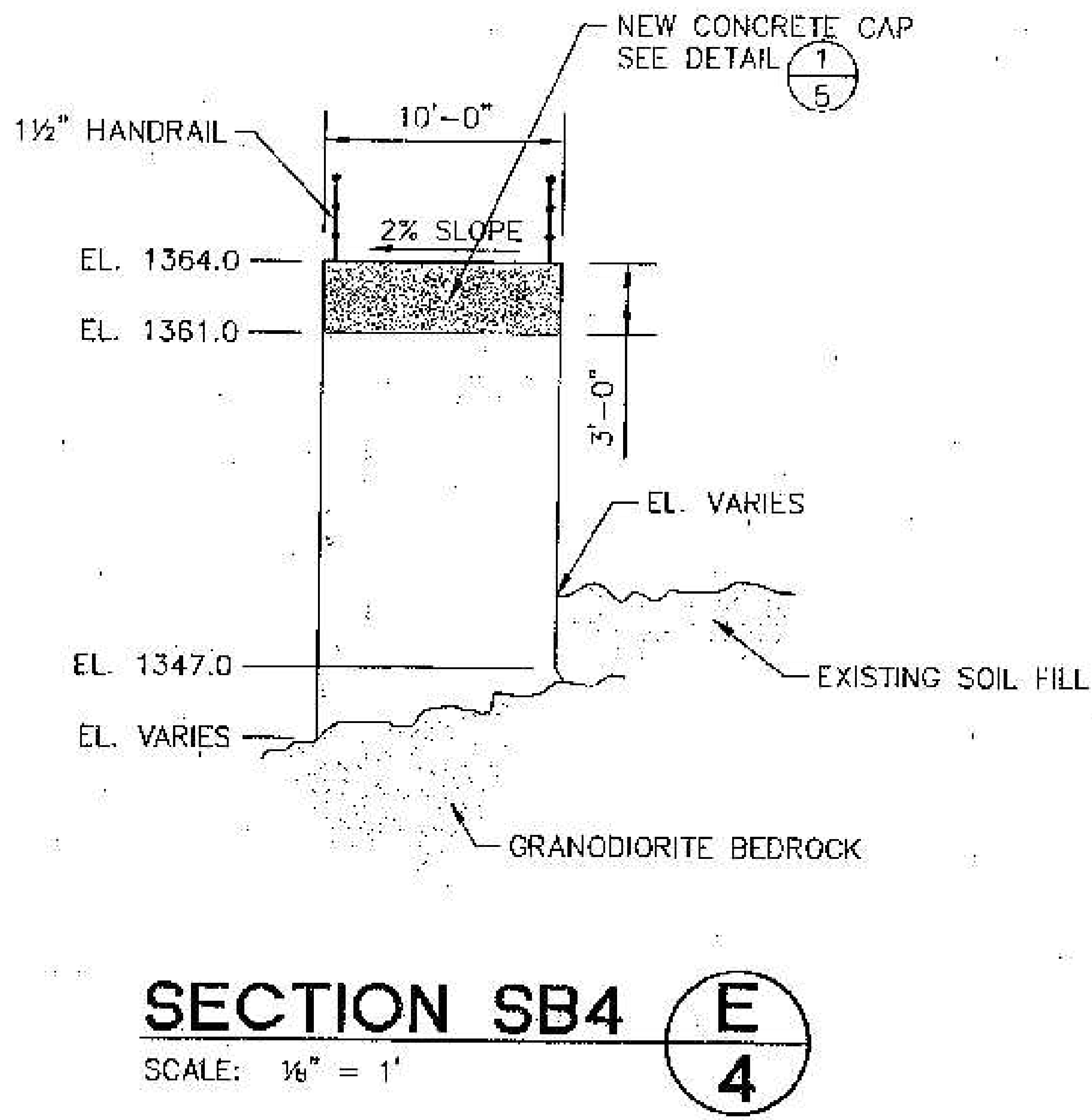

Figure 11 – Buttress Section SB4

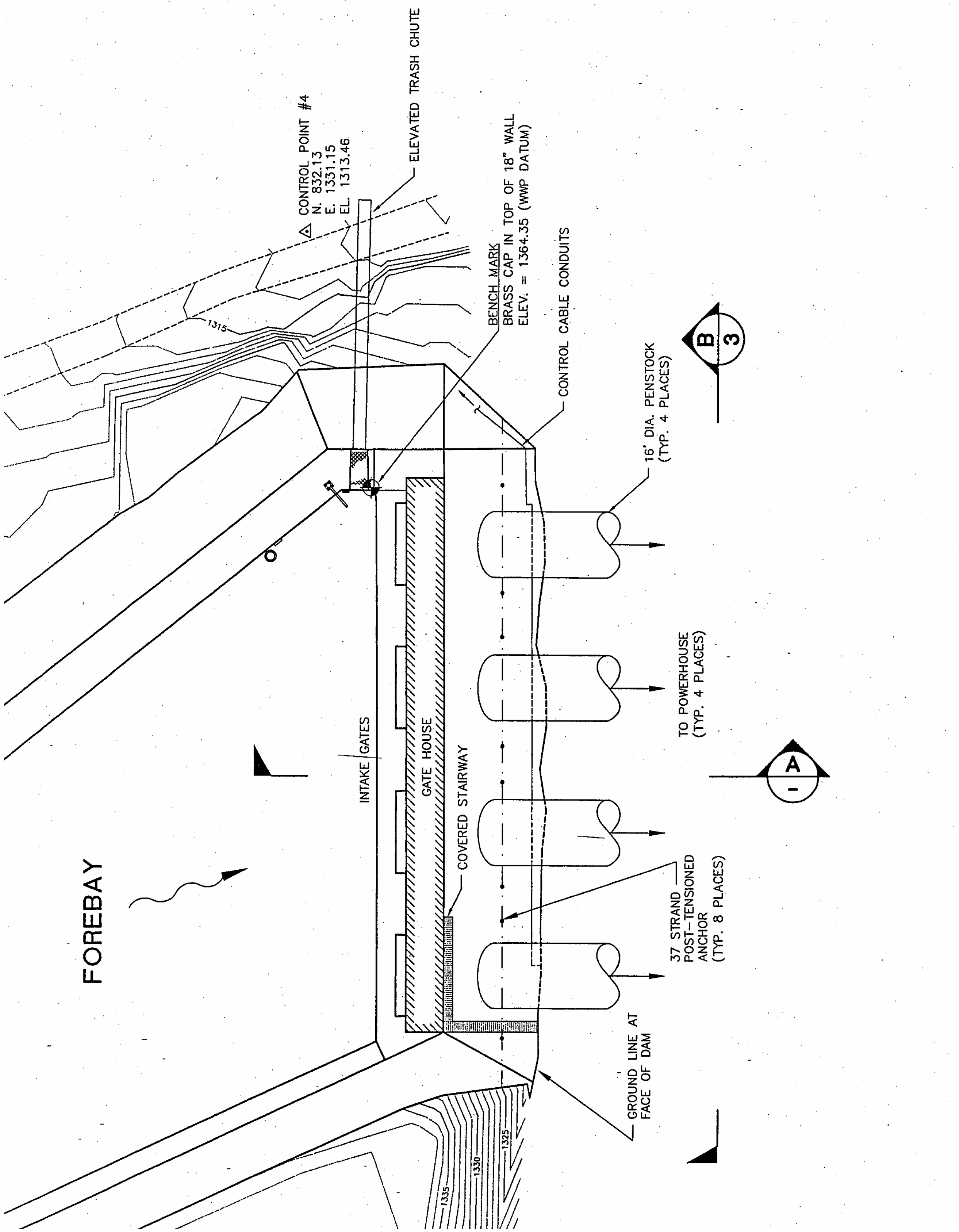

Figure 12 – Intake Plan, Anchor Locations

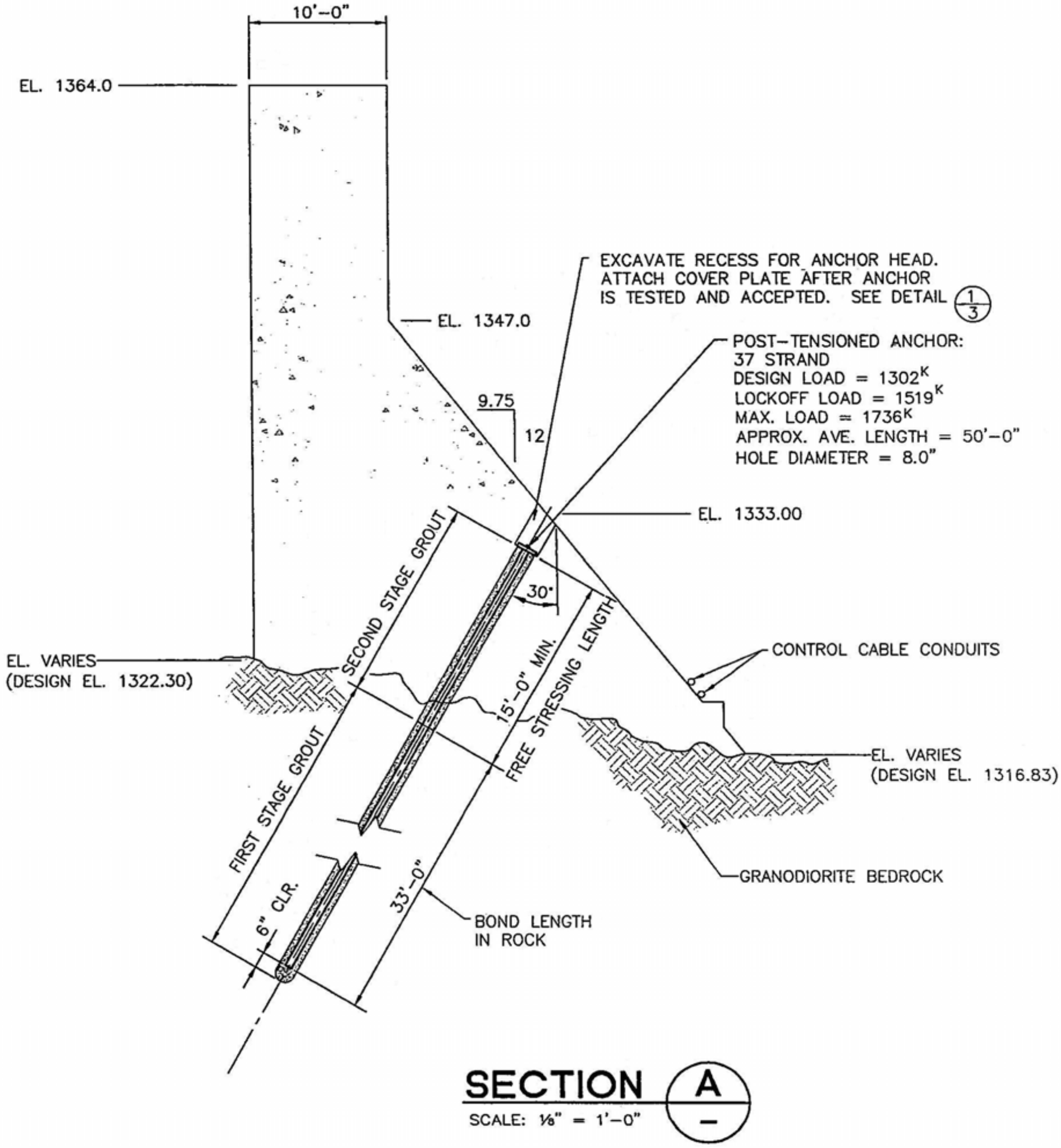

Figure 13 – Intake Section, Penstocks & Powerhouse Not Shown

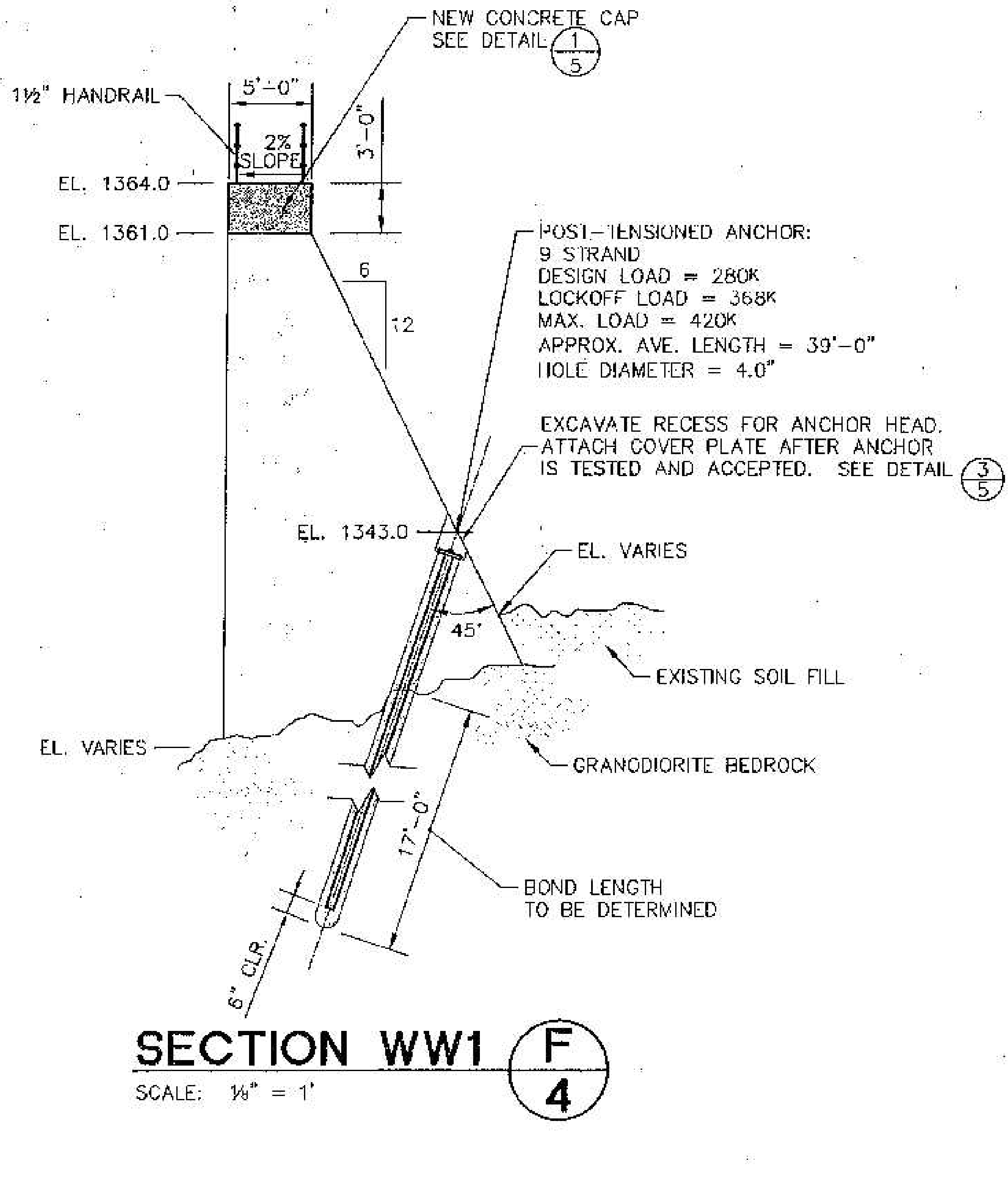

Figure 14 – Wingwall Section WW1

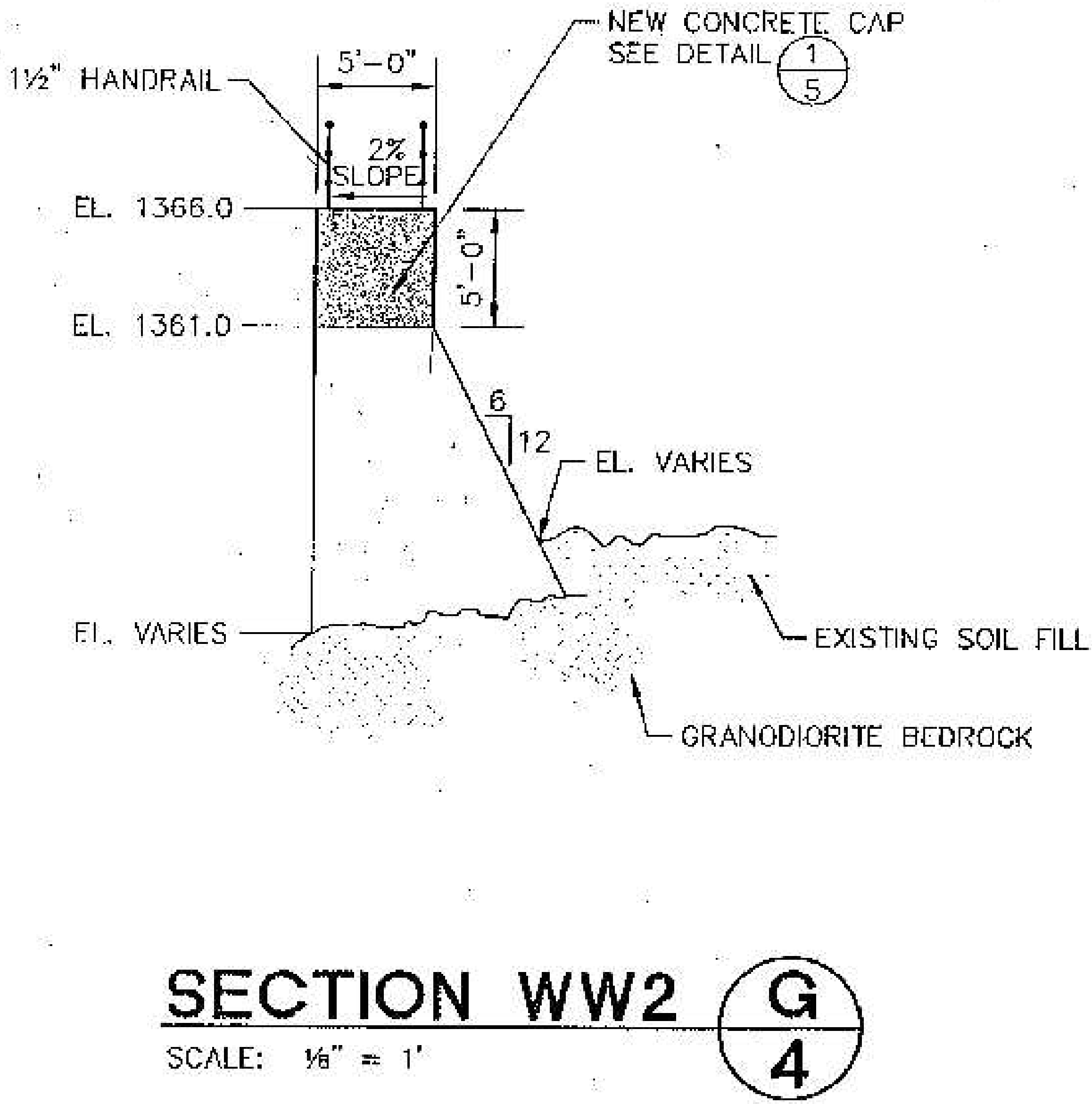

Figure 15 – Wingwall Section WW2

Appendix C - Photos

Photo 1 & 2 – Spillway Dam, Downstream Face of Dam (Top)
and Top of Flashboards (Bottom)

Photo 3 & 4 – Radial Gate Structure, Left End of Dam (Top) and Gate Structure & Downstream Face of Skin (Bottom)

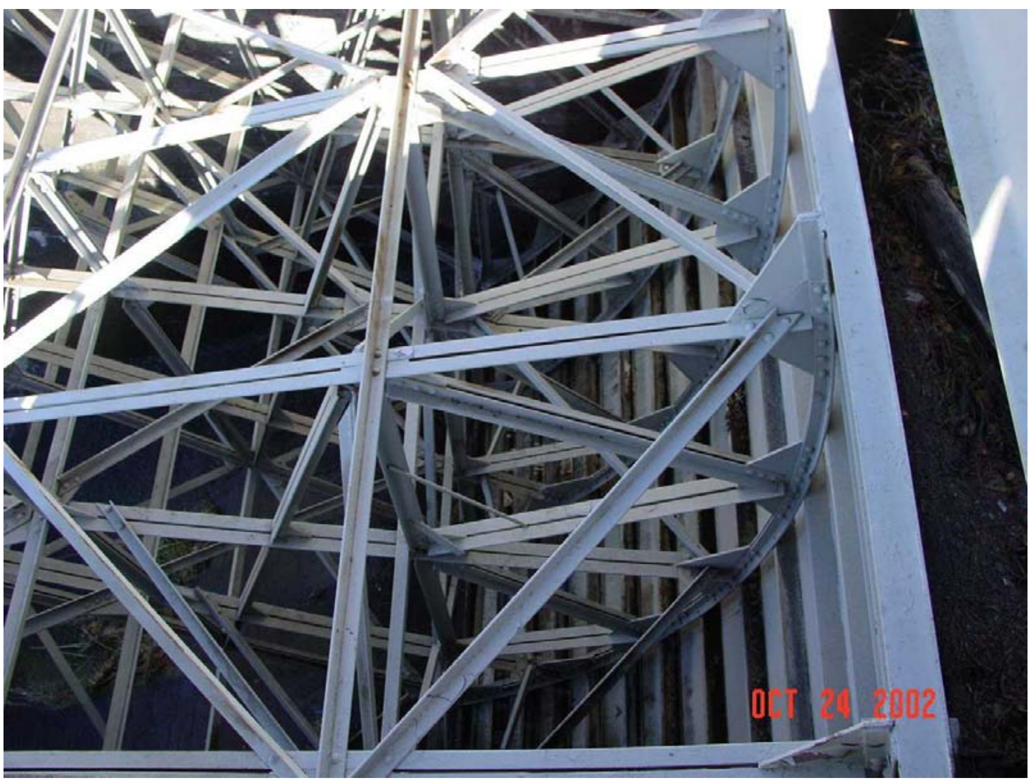

Photo 5 & 6 – Corner of Intake and Buttress Sections, (Top)
Vertical Joint/Crack (Bottom)

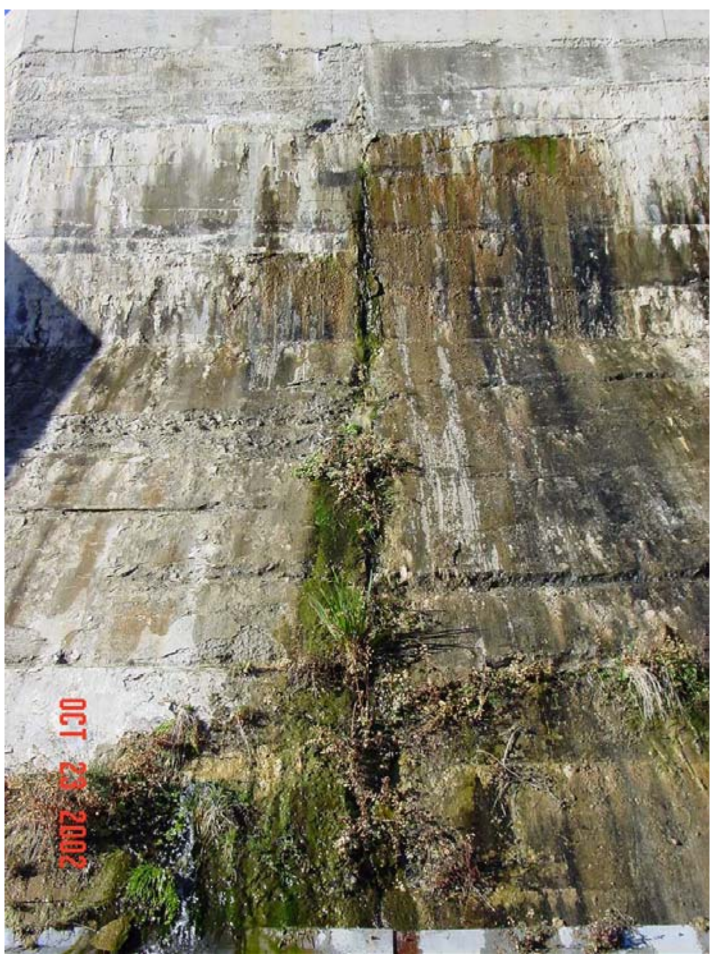

Photo 5 & 6 – Buttress Section (Top)
Top of Buttress Toe Block (Bottom)

Photo 7 & 8 – Downstream Face of Wingwall (Top), Same Area Showing Poor Bond Between Old & New Concrete (Bottom)

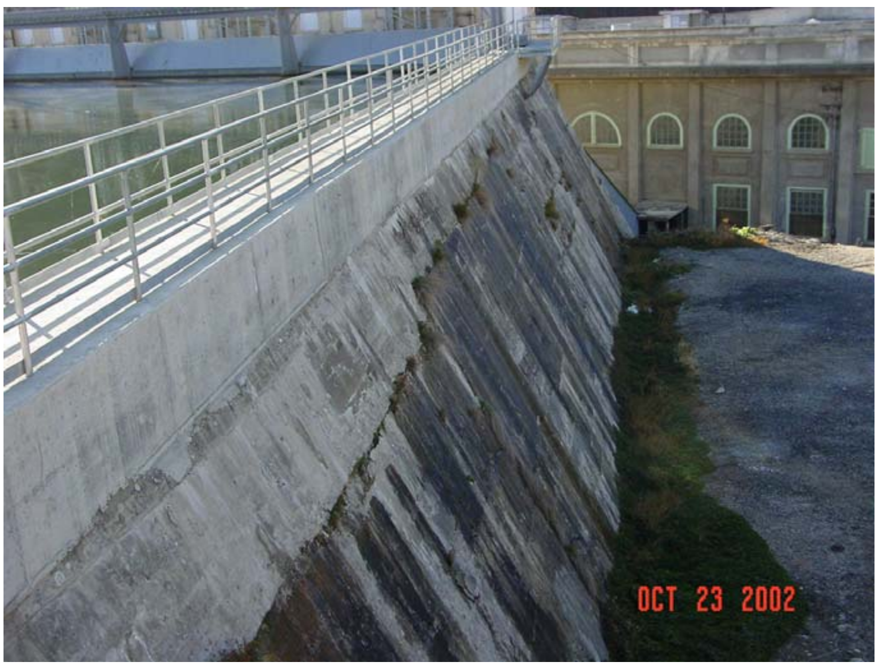

Photo 9 & 10 – Penstock Penetration at Intake Section, Leakage (Top),
Little Falls Rd Bridge, Above are Intake and Buttress Sections (Bottom)

Appendix D – Penstock Inspection Plan

LITTLE FALLS HYDROELECTRIC DEVELOPMENT
PENSTOCK INSPECTION PLAN

1. Purpose

Penstocks are conduits that transport water under pressure from the forebay to the turbines in the powerhouse. Performance parameters include structural integrity, minimum head loss, water tightness, and safety.

The purpose of a penstock inspection program is to detect potential problems that may cause interruption in plant operation or lead to penstock failure, and to ensure proper maintenance is performed. The condition of the penstocks and appurtenant structures is evaluated by visual and material inspections. Information collected during the inspections will be used to schedule maintenance and repairs.

2. Project Description

The Little Falls Development includes a gated and overflow spillway, non-overflow intake section and a separate powerhouse containing four turbine-generator units. The first unit went on line in 1909, and the powerhouse along with the final turbine-generator unit were completed in 1910. Hydraulic capacity is 1,800 cfs per unit for a total plant capacity of 7200 cfs.

3. Penstock Description

The four penstocks at Little Falls Hydroelectric Development are exposed, steel penstocks supported with concrete anchor and thrust blocks. The penstocks are sixteen (16) feet in diameter, tapering down to 14 feet 10 inches at the entrance to the turbine. Constructed of 1/2 inch riveted steel, they are 67 feet in length. Penstock anchor and thrust blocks are constructed of reinforced concrete and founded on rock. A typical drawing of the penstocks is attached.

Hydraulic capacity of each unit is 1800 cfs at a gross head of 84 feet, for a total plant capacity of 7200 cfs. Velocity, with a flow of 1800 cfs in the penstock, is approximately nine to ten feet per second.

The interior of the penstocks were originally coated with coal tar epoxy, and the exterior was coated with a lead based paint.

4. Inspections

A. External Visual Inspections

1. Routine Inspections

Project operators routinely inspect features of the plant on a regular basis. This inspection, which includes the penstocks, is intended to detect any abnormalities.

2. Visual Inspections

A more detailed visual inspection of the exterior of the penstock is performed annually. The inspections are the responsibility of the Hydro Safety staff. They are generally performed by a Civil Engineer and the Chief Project Operator or an HP&C mechanic. Appendix 'A' is a checklist to be completed for every annual inspection. In general, points to check for include:

(a) Alignment - Is there any indication of possible movement between penstock and anchor block or thrust block, or movement of the blocks?

(b) Leakage - Is there any visible leakage?
This could indicate:
- possible rivet failure.
- possible seal failure.
- possible corrosion point where a hole propagates through the penstock.
- possible puncture due to failure of concrete supports.

(c) Check rivets - Are any missing or failing?
- may indicate corrosion or excessive movement of penstocks.

(d) Corrosion in the penstock metal.
- check severity of corrosion; i.e., whether or not it is surface corrosion or goes deeper.

(e) Signs of fatigue.
- they may appear similar to stretch marks or deformation of the plate steel. If fatigue is suspected, hardness tests should be considered.

(f) Vegetation growing on the penstock surface.
- vegetation, such a moss, may indicate corrosion or it will cause corrosion.
- vegetation growing between concrete and steel indicate accumulating dirt and will cause corrosion, or it may be a possible leak.

(g) Check concrete anchors, saddles, and supports.
- are there any signs of movement? If so, detailed measurements should commence using higher order surveying techniques to monitor the movement.
- if there are any cracks, they should be measured during each inspection for any change in size which may indicate movement.
- spalling - What is the severity? Is there exposed rebar? What is the depth of spalling?

B. Penstock Material Inspection

1. Examination of the penstock plate steel shall be conducted by personnel familiar with non-destructive testing methods. Tests include thickness measurements with an ultrasonic thickness tester. This measures plate thickness and detects gross internal discontinuities. The measurements are performed such that the plate thickness and material loss of the steel plate can be monitored. Thickness examinations are initially scheduled every five years. Frequency will depend on conditions found during the examinations. When the safety factor for operation (based on strength of the remaining thickness in the steel) approaches two, the servicability of the penstocks should be closely evaluated.

2. Concrete supports are evaluated generally in accordance with ACI guidelines to determine extent of concrete deterioration. Non-destructive test methods to determine the condition of the concrete include a standard rock hammer or the rebound hammer to test for concrete soundness.

C. Internal Penstock Inspection

Internal inspections can be performed while the penstock is in a watered state using a Remotely Operated Vehicle (ROV). The ROV inspection will focus on the interior coating and any unusual indications. Further investigation involving manned entry into the penstock will occur if the ROV inspection detects areas of significant erosion, corrosion, or loss of lining material. Interior inspections of the full length of the penstocks will be scheduled when there is an indication of a problem.

5. Reports and Record Keeping

Information relating to the condition of the penstocks at Little Falls will be kept in a three-ring binder and include the following:

A. The checklist in Appendix 'A' completed for every visual inspection.
B. Photographs should be taken of joints, corrosion sites, concrete spalling, cracks in the anchor blocks, etc., to provide a photographic record. These are to be placed in a clear plastic sleeve and included in the inspection report.
C. Reports of maintenance performed on the penstocks or concrete supports.
D. Results of material testing.

Copies of the binder will be maintained by a Civil Engineer in the Generation Section, the Hydro Safety Administrator, the Project Superintendent, and the Senior HP&C Civil Engineer.

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Appendix 'A'

LITTLE FALLS PENSTOCK INSPECTION CHECKLIST

Date Inspected: ______________________ Time: ______________

Unit Inspected: ______________________

Inspected By: ______________________ Assisted By: ______________

Forebay Elevation at Time of Inspection: ____________

Reference Drawings: M-16704

ITEM	YES	NO	REMARKS
I. Penstock (exposed lengths between anchor blocks)			
A. Any visible misalignment?			
B. Any signs of leakage?			
C. Any loose, broken or missing rivets?			
D. Do the joints show:			
1) Visible displacement?			
2) Loss of joint material?			
3) Signs of leakage?			
E. Does the steel pipe show any:			
1) Corrosion?			
2) Vegetation?			
3) Flaking paint?			
4) Visible fatigue? (may appear like stretch or wrinkles)			
5) Deformation?			
6) Vibration?			
F. Other?			

ITEM	YES	NO	REMARKS
II. Thrust Block			
A. Any settlement or misalignment?			
1) Is there any sign of movement?			
B. Any cracks at:			
1) Penstock & concrete interface?			
2) Concrete & rock interface?			
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)			
2) Cracking? (measure crack width & depth)			
3) Erosion?			
4) Exposed rebar?			
5) Other?			

ITEM	YES	NO	REMARKS
III. Powerhouse Wall Where Penstock Enters Powerhouse			
A. Any settlement or misalignment?			
1) Is there any sign of movement?			
B. Any cracks at:			
1) Penstock & concrete interface?			
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)			
2) Cracking? (measure crack width & depth)			
3) Erosion?			
4) Exposed rebar?			
5) Other?			

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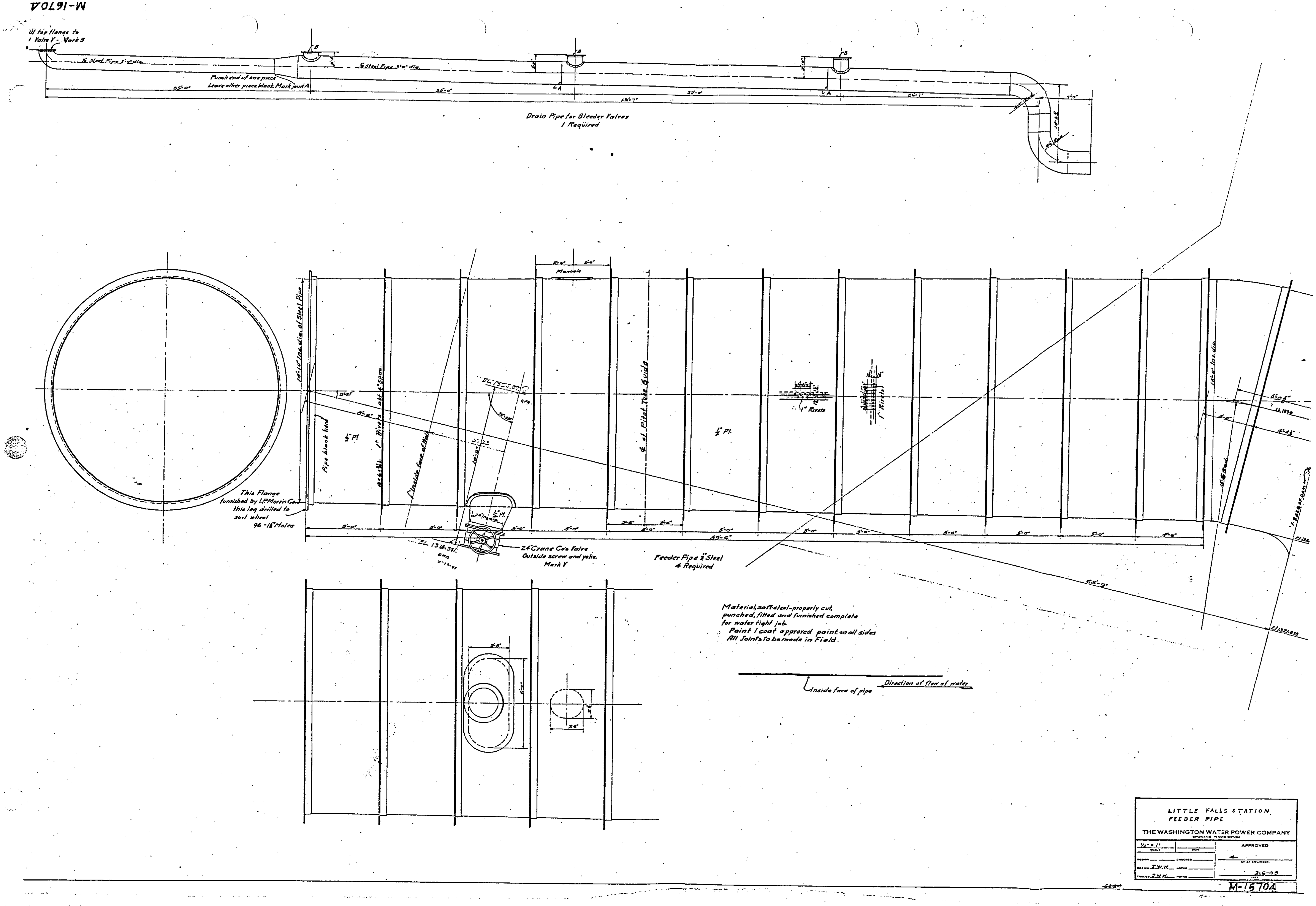

M-1670A
Drain Pipe for Bleeder Valves
1 Required
Punch end of one piece
Leave other piece blank. Mark joint A
This Flange
furnished by I.P. Morris Co.
this leg drilled to
suit wheel
96 - 1⅛" Holes
Pipe blank here
1" Rivets
€ of Pilot Tube Guide
Manhole
24" Crane Co's Valve
Outside screw and yoke.
Mark Y
Feeder Pipe ½" Steel
4 Required
Material, soft steel - properly cut,
punched, fitted and furnished complete
for water tight job.
Paint 1 coat approved paint on all sides
All Joints to be made in Field.
Inside face of pipe
Direction of flow of water
LITTLE FALLS STATION
FEEDER PIPE
THE WASHINGTON WATER POWER COMPANY
SPOKANE WASHINGTON
APPROVED
3-6-09
M-1670A

Appendix 'A'

LITTLE FALLS PENSTOCK INSPECTION CHECKLIST

Date Inspected: July 24, 2002 Time: 10:00

Unit Inspected: #1

Inspected By: Steve Schultz Assisted By: Larry Garbarino

Forebay Elevation at Time of Inspection: ____________

Reference Drawings: M-16704

ITEM	YES	NO	REMARKS
I. Penstock (exposed lengths between anchor blocks)			
A. Any visible misalignment?		✓	
B. Any signs of leakage?		✓	
C. Any loose, broken or missing rivets?		✓	
D. Do the joints show:			
1) Visible displacement?		✓	
2) Loss of joint material?		✓	
3) Signs of leakage?		✓	
E. Does the steel pipe show any:			
1) Corrosion?		✓	
2) Vegetation?		✓	
3) Flaking paint?		✓	
4) Visible fatigue? (may appear like stretch or wrinkles)		✓	
5) Deformation?		✓	
6) Vibration?		✓	
F. Other?		✓	

ITEM	YES	NO	REMARKS
II. Thrust Block			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?		✓	
2) Concrete & rock interface?		✓	
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)		✓	
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?		✓	

ITEM	YES	NO	REMARKS
III. Powerhouse Wall Where Penstock Enters Powerhouse			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?		✓	
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)		✓	3-4 minor hairline cracks radiating from penstock.
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?		✓	

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Appendix 'A'

LITTLE FALLS PENSTOCK INSPECTION CHECKLIST

Date Inspected: July 24, 2002 Time: 10:45

Unit Inspected: #2

Inspected By: Steve Schultz Assisted By: Larry Garbarino

Forebay Elevation at Time of Inspection: ______

Reference Drawings: M-16704

ITEM	YES	NO	REMARKS
I. Penstock (exposed lengths between anchor blocks)			
A. Any visible misalignment?		✓	
B. Any signs of leakage?		✓	
C. Any loose, broken or missing rivets?		✓	
D. Do the joints show:			
1) Visible displacement?		✓	
2) Loss of joint material?		✓	
3) Signs of leakage?		✓	Minor leakage @ dam. Left side
E. Does the steel pipe show any:			
1) Corrosion?		✓	
2) Vegetation?		✓	
3) Flaking paint?		✓	
4) Visible fatigue? (may appear like stretch or wrinkles)		✓	
5) Deformation?		✓	
6) Vibration?		✓	
F. Other?		✓	

ITEM	YES	NO	REMARKS
II. Thrust Block			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?		✓	
2) Concrete & rock interface?		✓	
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)		✓	
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?		✓	

ITEM	YES	NO	REMARKS
III. Powerhouse Wall Where Penstock Enters Powerhouse			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?		✓	
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)		✓	
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?		✓	

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Appendix 'A'

LITTLE FALLS PENSTOCK INSPECTION CHECKLIST

Date Inspected: July 24, 2002 Time: 11:00

Unit Inspected: #3

Inspected By: Steve Schultz Assisted By: Larry Garbarino

Forebay Elevation at Time of Inspection:

Reference Drawings: M-16704

ITEM	YES	NO	REMARKS
I. Penstock (exposed lengths between anchor blocks)			
A. Any visible misalignment?		✓	
B. Any signs of leakage?		✓	
C. Any loose, broken or missing rivets?		✓	
D. Do the joints show:			
1) Visible displacement?		✓	
2) Loss of joint material?		✓	
3) Signs of leakage?		✓	slight leakage on dam face near penstock.
E. Does the steel pipe show any:			
1) Corrosion?		✓	
2) Vegetation?	✓		Some vegetation @ stiffener ribs
3) Flaking paint?		✓	
4) Visible fatigue? (may appear like stretch or wrinkles)		✓	
5) Deformation?		✓	
6) Vibration?		✓	
F. Other?		✓	

ITEM	YES	NO	REMARKS
II. Thrust Block			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?		✓	
2) Concrete & rock interface?		✓	
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)		✓	
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?	✓		Moss at top at penstock interface

ITEM	YES	NO	REMARKS
III. Powerhouse Wall Where Penstock Enters Powerhouse			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?			
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)	✓		Minor crack in wall @ bottom of penstock.
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?		✓	

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Appendix 'A'

LITTLE FALLS PENSTOCK INSPECTION CHECKLIST

Date Inspected: July 24, 2002 Time: 11:00

Unit Inspected: #4

Inspected By: Steve Schultz Assisted By: Larry Garbarino

Forebay Elevation at Time of Inspection: ________

Reference Drawings: M-16704

ITEM	YES	NO	REMARKS
I. Penstock (exposed lengths between anchor blocks)			
A. Any visible misalignment?		✓	
B. Any signs of leakage?		✓	
C. Any loose, broken or missing rivets?		✓	
D. Do the joints show:			some concrete spalling on dam face at bottom of p[illegible]
1) Visible displacement?		✓	
2) Loss of joint material?		✓	
3) Signs of leakage?		✓	Dam face is wet from leakage.
E. Does the steel pipe show any:			
1) Corrosion?		✓	
2) Vegetation?	✓		some vegetation at stiffeners some moss in joints near th[illegible]
3) Flaking paint?		✓	
4) Visible fatigue? (may appear like stretch or wrinkles)		✓	
5) Deformation?		✓	
6) Vibration?		✓	
F. Other?		✓	

ITEM	YES	NO	REMARKS
II. Thrust Block			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?	✓		
2) Concrete & rock interface?		✓	
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)	✓		slight surface spalling, spotty.
2) Cracking? (measure crack width & depth)		✓	Small crack at stiffener downstream side
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?	✓		Moss at top of block at penstock interface

ITEM	YES	NO	REMARKS
III. Powerhouse Wall Where Penstock Enters Powerhouse			
A. Any settlement or misalignment?		✓	
1) Is there any sign of movement?		✓	
B. Any cracks at:			
1) Penstock & concrete interface?			small crack
C. Do the concrete surfaces show:			
1) Spalling? (measure and note depth)		✓	
2) Cracking? (measure crack width & depth)		✓	
3) Erosion?		✓	
4) Exposed rebar?		✓	
5) Other?		✓	

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Appendix E – Hydro Activities Summary

HYDRO ACTIVITIES SUMMARY
Little Falls HED (LI54-0069, LI54-0653)
October 1995 – October 2002

A. **Safety of Project**

1. **Dams, Spillgates, & Appurtenant Structures**

- Installed new emergency generator near spillgates with remote operation capability from control room in 1995.
- Sandblasted & painted penstock exteriors in 1998.
- Installed fiber optic cable to spillgates (controls or lifting mechanisms) in 1998.
- Completely replaced all flashboards in 1999; partial replacement of boards, 2000-2002.
- Completed dam safety stability improvements to wingwall (west) & buttress (east) sections in spring of 1999. The improvements consisted of a combination of tendoning, additional concrete buttressing, grouting, & adding concrete to crest.
- Completed dam stability improvements to intake section in spring of 2000. The improvements consisted of tendoning & grouting.
- Spillgates are operated and/or tested annually. Both east & west gates were last <u>fully</u> opened on April 17, 2002. Last operation (partial opening) of east gate occurred on September 2, 2002 (for purposes of supplying fish water); last operation (partial opening) of west gate occurred on June 10, 2002 (for purposes of flood passage).
- All four penstocks were inspected in late July 2002. In general, all penstocks are in excellent condition: they are well-supported, with no indication of settlement or misalignment; exteriors are in good condition, with only a few minor rust spots; no external signs of leakage from penstocks; there is some leakage through the concrete transitions; inside of penstocks are in good condition with only minor scaling.

2. **Instrumentation & Monitoring**

- Little Falls is normally inspected twice every twelve hours. Specific inspection areas include the main dam, intakes, spillway, and reservoir. Forebay and tailrace elevations are continually monitored, both visually via staff gages and electronically through a digital display in the control room.

B. Operation, Maintenance, and Improvements

1. Operation

- Little Falls is physically manned by a Control Room Operator from 0600 to 1800 hours daily. An operator is also on duty from 1800 to 0600 hours, but he/she splits his/her shift between Little Falls and Long Lake HED (4.6 miles upstream), providing coverage for both facilities.

- The facility is under continuous surveillance by two color cameras remotely operated from the control room. The cameras, each featuring a 360 degree swivel and a zoom lens, enable the station operator to view the forebay, spillway, and surrounding areas via two color monitors.

- Normal station service is provided off the plant's two 4 kV buses, fed by the four plant generators. Back-up station service is provided from the 115 kV bus, fed from either the Little Falls #1 or Little Falls #2 tie line. To ensure spillgate operation, an emergency diesel generator is started when no external sources of power are available. This generator is tested monthly. Another alternate source of emergency power is the UPS backup system provided by the station battery. The UPS provides emergency power for the video and computer systems and the wicket gate closing motors.

- An operator at Long Lake can remotely monitor Little Falls' forebay and tailrace levels via computer. From Long Lake, the operator can also control Little Falls' emergency generator, remotely operate Little Falls' spillgates and trashgate, and remotely adjust the load of Little Falls' generating units. The Little Falls units can be completely shut down from Long Lake, but they cannot be remotely started from that site.

2. Maintenance and Improvements

- Installed shaft vibration monitors and bearing temperature indication for all four turbine generator units, begun in 1995, completed in 2000.

- Repaired/replaced trashboom in 1997.

- Updated/upgraded video surveillance monitors in 1999.

- Installed new 24 VDC battery system for instrumentation power supply in 2000.

- Installed new plant PLC for station alarms and Unit 4 instrumentation in 2000.

- Replaced trash racks and intake deck and installed new trashrake in 2001.

- Replaced Unit 4 turbine runner in 2001.

- Installed new governor on Unit 4 in 2001.

C. Environmental, Public Use, & Public Safety

1. Environmental (all done in cooperation with Spokane Tribe of Indians)

- $20,000 cooperative funds applied to scholarship and training programs for Spokane Tribe.

- Monitored water quality including total dissolved gas, temperature and dissolved oxygen at three locations in the Spokane River for three years. Monitoring was completed in 2002.

- Established a monitoring schedule for a minimum flow water gaging and recording system in 2000. Minimum flow requirements are: 500 cfs when Grand Coulee Dam is at or below elevation 1281 feet; 200 cfs at all other times.

- Developed site-specific plan and design for fish collection and acclimation facility completed in 1999. Approximately 140,000 fish were released from this facility by spring 2000.

- Cooperatively purchased 2,356 acres of land through a habitat fund by 2001. Included forest improvement programs.

2. Public Use & Public Safety

- Emergency Action Plan (EAP) is required. Plan is updated at least once a year; updates are sent to all planholders including Washington State DOE, Dam Safety Division. Last flowchart updates mailed to planholders on 10/01/02. Annual EAP exercises are conducted in conjunction with Long Lake HED (4.6 miles upstream). Last annual EAP exercise was conducted on Sunday, 09/01/02 (Labor Day weekend) and involved a terrorist scenario; last formal EAP training session for operators was held on 10/16/02; training worksheets are completed annually each September-October.

- Tabletop and functional EAP exercises were held for Long Lake / Little Falls during summer of 2000. Approximately 45 attendees from various agencies were present at each exercise. Washington State DOE, Dam Safety Division, was invited to both exercises, but was unable to attend either one.

- Complete Little Falls and Long Lake EAP books and one-page summary sheets highlighting "Operator EAP Responsibilities" are posted in control rooms at both Long Lake and Little Falls. Plant-specific "bomb threat procedures" also posted in control rooms.

- Bridges and immediate area downstream of powerhouse continue to receive heavy recreational use by fishermen.

- Area below powerhouse and spillway is fenced and extensively posted with warning signage (reflective, with pictographs) to deter recreators from fishing in channel area between spillway and bridges. Warning signs are inspected and replaced as needed. Avista cooperates with Spokane Tribal and BIA law enforcement to ensure public safety in immediate area.

- Avista ran ½ page, site-specific fishing safety ad for Little Falls (with photograph showing actual danger spots) in *Rawhide Press* (Spokane Tribal newspaper) for three consecutive months each in 1998, 1999, and 2000. Ad received positive feedback from tribal members.

- Updated hydro recreational & safety information is available on Avista Utilities web site at www.avistautilites.com/home.asp. (Click on "Resources & Transmission," then "Hydropower," then either "Recreational Opportunities" or "Hydroelectric Safety"). Students can also access safety information by visiting "Wattson's Kids Page" from the main Avista Utilities web site.

D. Security

1. General

- Safety/security survey of all Avista facilities completed in December 2001.
- Avista uses same color-coded "threat level" system (green, blue, yellow, orange, red) as U.S. Department of Homeland Security.
- Avista has issued physical response guidelines (last revision, July 2002) corresponding to each of the five threat levels.
- Avista uses risk analysis similar to RAM-D formula to assess potential risk for each hydroelectric facility.

2. Little Falls Plant Specific

- Plant has surveillance cameras.
- Site is manned and normally inspected four times per day.
- Law enforcement numbers are posted in control room.
- Plant-specific "bomb threat procedures" are posted in control room.
- Doors and windows are locked.
- Facility can be remotely monitored from Long Lake control room.
- Little Falls laundry and garbage pickup now transported to Long Lake and placed with Long Lake pickup (outside plant fence).
- Tours were suspended from September 2001 through March 2002. Tours are now approved and scheduled in advance, with adults subject to ID check.
- Additional security information is classified.